VOLUME 12 NUMBER 11 / JUNE 8, 1974

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N74-19637 Southern Methodist Univ., Dallas, Tex.
THE SEPARATING TURBULENT BOUNDARY LAYER: AN EXPERIMENTAL STUDY OF AN AIRFOIL TYPE FLOW Ph.D. Thesis
James Hassler Strickland, Jr. 1973 237 p
Avail: Univ. Microfilms Order No. 74-5178

Experimental measurements in a separating turbulent boundary layer were made. Mean velocity and turbulence intensity profiles were obtained using hot film and laser anemometry. Mean and fluctuating wall shear stress distributions were obtained using flush mounted hot film sensors. The bursting frequency at various streamwise locations was also obtained from the wall hot film sensors. The intermittency was obtained utilizing a photo-electric technique. The celerities of various eddy structures were obtained by using a double hot film probe. It was found that the bursting frequency could be obtained from the wall shear stress spectra based on comparison of spectra, short time autocorrelations, and Rao's correlation.
Dissert. Abstr.

N74-19638 Virginia Univ., Charlottesville.
DOWNWASH-VELOCITY POTENTIAL METHOD FOR OSCILLATING SURFACES USING AERODYNAMIC ELEMENTS IN SUBSONIC AND SUPERSONIC FLOWS Ph.D. Thesis
Young Sik Yoo 1973 185 p
Avail: Univ. Microfilms Order No. 73-32465

Steady and unsteady aerodynamic loads are used in many types of structural and aeroelastic analyses of aircraft, such as flutter, gust and frequency response analyses. The application of the downwash-velocity potential method to the case of oscillating surfaces in subsonic and supersonic flows is developed. Calculated unsteady aerodynamic forces are given on rectangular wings, swept wings with or without control surfaces and T-tail configurations in subsonic flows. For supersonic flows steady aerodynamic forces are calculated on rectangular wings of various aspect ratios. The subsonic results are compared with other results published in the literature for reduced frequencies up to nine tenths, and for Mach numbers up to nine tenths. In supersonic flows steady aerodynamic coefficients are compared for Mach numbers ranging 1.2 to 1.8. Generally the results are shown to be in satisfactory agreement with other published results, for both subsonic and supersonic speeds. The concept of aerodynamic elements is presented, the computed results representing four possible types of rectangular elements. Dissert. Abstr.

N74-19639 Oklahoma Univ., Norman.
A LIFTING LINE ANALYSIS OF NONPLANAR WINGS Ph.D. Thesis
William A. Edgington 1973 138 p
Avail: Univ. Microfilms Order No. 74-4008

An equation relating the spanwise circulation distribution to the induced velocity at a given spanwise station for a nonplanar wing is developed using lifting line theory. The equation has as its unknowns the Fourier coefficients used to describe the circulation distribution. A system of non-homogeneous simultaneous equations results and is solved by the method of collocation. The proximity of a collocation point very near the wing tip is studied for wings having a semi-elliptical shape. As a result the downwash distributions very near the wing tip are in error and the arc length distance from the wing tip for the first collocation point must be restricted as to not affect the overall circulation distribution. The validity of lifting line theory for the special case of a semi-circular shape is investigated by using lifting surface theory and allowing the ratio of the chord to circle radius to become very small. The results compare to those developed using lifting line theory. Dissert. Abstr.

N74-19640*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INPUT DESCRIPTION FOR JAMESON'S THREE-DIMENSIONAL TRANSONIC AIRFOIL ANALYSIS PROGRAM
Perry A. Newman and Ruby M. Davis 7 Feb. 1974 27 p refs
(NASA-TM-X-71919) Avail: NTIS HC $4.50 CSCL 01A

The input parameters are presented for a computer program which performs calculations for inviscid isentropic transonic flow over three dimensional airfoils with straight leading edges. The free stream Mach number is restricted only by the isentropic assumption. Weak shock waves are automatically located where they occur in the flow. The finite difference form of the full equation for the velocity potential is solved by the method of relaxation, after the flow exterior to the airfoil is mapped to the upper half plane. Author

N74-19641*# Scientific Translation Service, Santa Barbara, Calif.
DIRECT CALCULATION OF AIRFOILS FROM PRESSURE DISTRIBUTION
R. Eppler Washington NASA Mar. 1974 64 p refs Transl. into ENGLISH from Ing.-Arch. (Berlin), v. 25, no. 1, 1957 p 32-57
(Contract NASw-2483)
(NASA-TT-F-15417) Avail: NTIS HC $6.25 CSCL 01A

A method for determining airfoil profiles from the pressure or velocity distribution is described. The numerical factors make it possible to specify the profile thickness and to calculate the entire profile series by superposition. A minor disadvantage in the method is discussed and the procedure for correcting the discrepancy is analyzed. Mathematical models of the method are developed. The data for various types of airfoils are presented in graph form. Author

N74-19642*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

COLD-AIR INVESTIGATION OF A TURBINE FOR HIGH TEMPERATURE-ENGINE APPLICATION. 5: TWO-STAGE TURBINE PERFORMANCE AS AFFECTED BY VARIABLE STATOR AREA

Frank P. Behning, Harold J. Schum, and Edward M. Szanca Washington Apr. 1974 40 p refs
(NASA-TN-D-7571; E-7671) Avail: NTIS HC $3.25 CSCL 20D

The stator areas of the design two-stage turbine were both decreased and increased by nominally 30 percent, and the performances of the two turbines are compared with that of the design stator area turbine. Turbine efficiency decreased with stator area changes. Closing the stator area resulted in the more severe efficiency loss. The decrease in efficiency for both turbines is attributable to rotor incidence, off-design blade-surface velocities, and adverse reaction changes across the blade rows. Author

N74-19643*# General Dynamics/Fort Worth, Tex. Convair Aerospace Div.

AN EXPERIMENTAL INVESTIGATION OF LEADING-EDGE VORTEX AUGMENTATION BY BLOWING

R. G. Bradley, W. O. Wray, and C. W. Smith 1 Apr. 1974 93 p refs
(Contract NAS1-12682)
(NASA-CR-132415) Avail: NTIS HC $7.75 CSCL 20D

A wind tunnel test was conducted to determine the effects of over-the-wing blowing as a means of augmenting the leading-edge vortex flow of several pointed-tip, sharp-edged planforms. Arrow, delta, and diamond wings with leading-edge sweeps of 30 and 45 degrees were mounted on a body-of-revolution fuselage and tested in a low-speed wind tunnel at a Mach number of 0.2. Nozzle location data, pitch data, and flow-visualization pictures were obtained for a range of blowing rates. Results show pronounced increases in vortex lift due to the blowing. Author

N74-19644*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

RESEARCH TURBINE FOR HIGH-TEMPERATURE CORE ENGINE APPLICATION. 2: EFFECT OF ROTOR TIP CLEARANCE ON OVERALL PERFORMANCE

Edward M. Szanca, Frank P. Behning, and Harold J. Schum Washington Apr. 1974 30 p refs
(NASA-TN-D-7639; E-7728) Avail: NTIS HC $3.25 CSCL 21E

A 25.4-cm (10-in) tip diameter turbine was tested to determine the effect of rotor radial tip clearance on turbine overall performance. The test turbine was a half-scale model of a 50.8-cm-(20-in.-) diameter research turbine designed for high-temperature core engine application. The test turbine was fabricated with solid vanes and blades with no provision for cooling air and tested at much reduced inlet conditions. The tests were run at design speed over a range of pressure ratios for three different rotor clearances ranging from 2.3 to 6.7 percent of the annular blade passage height. The results obtained are compared to the results obtained with three other turbines of varying amounts of reaction. Author

N74-19645*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PRESSURE-LOSS AND FLOW COEFFICIENTS INSIDE A CHORDWISE-FINNED, IMPINGEMENT, CONVECTION, AND FILM AIR-COOLED TURBINE VANE

Steven A. Hippensteele Washington Apr. 1974 29 p refs
(NASA-TM-X-3028; E-7719) Avail: NTIS HC $3.25 CSCL 20D

Total-pressure-loss coefficients, flow discharge coefficients, and friction factors were determined experimentally for the various area and geometry changes and flow passages within an air-cooled turbine vane. The results are compared with those of others obtained on similar configurations, both actual and large models, of vane passages. The supply and exit air pressures were controlled and varied. The investigation was conducted with essentially ambient-temperature air and without external flow of air over the vane. Author

N74-19646# Douglas Aircraft Co., Inc., Long Beach, Calif.

A THEORETICAL METHOD FOR CALCULATING THE AERODYNAMIC CHARACTERISTICS OF ARBITARY JET-FLAPPED WINGS. VOLUME 1: THE ELEMENTARY VORTEX DISTRIBUTION JET-WING LIFTING SURFACE THEORY Final Technical Report

Michael L. Lopez, C. -C. Shen, and Norman F. Wasson May 1973 149 p refs
(Contract N00014-71-C-0250; NR Proj. 214-189)
(AD-773939; MDC-J5519-Vol-1) Avail: NTIS CSCL 01/1

The report describes a lifting surface theory for calculating the aerodynamic characteristics of jet-flapped wings. Based on a finite-element scheme the method of Elementary Vortex Distribution or the EVD method, the wing and jet sheet are represented by a set of overlapped elementary vortex distributions. A solution is obtained by satisfying a set of mixed-type boundary conditions on both the wing and jet sheet. The EVD method, as described, provides the following: spanwise and chordwise loading; spanwise variation of induced drag; a capability to investigate the effects of part span flaps, part span blowing, rolling, yawing, pitching, and sideslip; and total lift and induced drag (momentum method), pitching moment, yawing and rolling moments, and side force. (Modified author abstract) GRA

N74-19647# Naval Ordnance Lab., White Oak, Md.

WRAP-AROUND-FIN (WAF) PRESSURE DISTRIBUTION

John E. Holmes 1 Oct. 1973 117 p refs
(AD-773441; NOLTR-73-107) Avail: NTIS CSCL 19/4

The principal difference between a wrap around fin and a planar fin is that the WAF exhibits an induced rolling moment at zero degree angle of attack, while a straight fin has none. The Naval Ordnance Laboratory, along with other members of The Technical Cooperation Program, initiated a joint investigation into the causes of the induced roll moment. Measurements of the pressure distribution over both the convex and concave sides of a WAF showed that the primary difference in pressure across the fin occurred immediately behind the leading edge with the pressure on the convex side apparently being affected more by the curvature than that on the concave side. In general, for a WAF with fixed curvature, it appeared that the physical characteristic which would have the most effect on changing the roll moment would be the fin cross-sectional profile, especially the leading-edge profile. Author (GRA)

N74-19648# TRW Systems Group, Redondo Beach, Calif.

TURBULENT WAKES Final Technical Report

Eric Baum 31 Dec. 1973 30 p refs
(Contract N00014-72-C-0448; ARPA Order 1801)
(AD-773651; TRW-23028-6002-RU-00) Avail: NTIS CSCL 01/1

Summarizes turbulence model equations and finite difference techniques for solving time-dependent compressible turbulent near wake flows. Turbulence properties are described in terms of two variables, the turbulent kinetic energy and an integral length scale. The resulting six partial differential equations are solved using an alternating-direction implicit finite difference method. Solutions are presented for hypersonic flows. Author (GRA)

N74-20034 Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).

MEASUREMENT ACCURACY REQUIREMENTS FOR THE DESIGN OF A BALLISTIC MISSILE SYSTEM [MESSGENAUIGKEITSFORDERUNGEN BEI DER AUSLEGUNG EINES FLUGKOERPERSYSTEMS]

E. Ahlborn *In* Inst. Franco-Allemand de Rech. Meas. Methods in Ballistics 1973 p 71-105 In GERMAN (For availability see N74-20028 11-14)

N74-20040 Institut Franco-Allemand de Recherches, St. Louis (France).

ACCURACY OF THE GLOBAL DRAG COEFFICIENT OF A PROJECTILE IN FLIGHT DERIVED FROM DOPPLER-FIZEAU RADAR MEASUREMENTS [SUR LE COEFFICIENT DE TRAINEE GLOBALE D'UN PROJECTILE EN VOL, DEDUIT DE MESURES FAITES PAR RADAR DOPPLER-FIZEAU PRECISION]

M. Giraud and G. Simon *In its* Meas. Methods in Ballistics

1973 p 209-229 refs In FRENCH (For availability see N74-20028 11-14)

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N74-19649 Case Western Reserve Univ., Cleveland, Ohio.
STUDIES IN TILT-ROTOR VTOL AIRCRAFT AEROELASTICITY Ph.D. Thesis
Raymond George Kvaternik 1973 671 p
Avail: Univ. Microfilms Order No. 74-2538

The results of some aeroelastic and dynamic studies which complement and extend various aspects of technology applicable to tilt-rotor VTOL aircraft are presented. Particular attention is given to proprotor/pylon whirl instability, a precession-type instability akin to propeller/nacelle whirl flutter. The blade flapping and pitch-change freedoms of a proprotor are shown to lead to a fundamentally different situation as regards the manner in which the precession-generated aerodynamic forces and moments act on the pylon and induce whirl flutter relative to that of a propeller. The implication of these forces and moments with regard to their capacity for instigating a whirl instability is examined, demonstrating, apparently for the first time, precisely why a proprotor can exhibit whirl flutter in either the backward or foward directions in contrast to a propeller which is found to always whirl in the backward direction. Dissert. Abstr.

N74-19650 Tennessee Univ., Knoxville.
NEAR-FIELD SUPERSONIC FLOW PATTERN OF SLENDER DELTA WINGS SONIC BOOM APPLICATIONS Ph.D. Thesis
Sarat Chandra Praharaj 1973 191 p
Avail: Univ. Microfilms Order No. 74-3859

Analytical methods that are capable of accurately predicting the near-field flow pattern about arbitrary aircraft configuration for design optimization in connection with sonic boom are discussed. The theory of linearized conical flow has been applied to calculate pressure distributions over slender delta wings and at points in the field away from the wings. The present study also gives linearized results of the variations of some of the important wing parameters. Near-field flow patterns due to both first and second order conical flow fields around delta wings have been worked out. Slender delta wings with constant angle of attack, camber, twist and different kinds of thickness distributions both along the span and chord have been considered. Suitable superposition of some of these flows has been described. Dissert. Abstr.

N74-19651*# Massachusetts Inst. of Tech., Cambridge. Flight Transportation Lab.
AIRCRAFT REQUIREMENTS FOR LOW/MEDIUM DENSITY MARKETS
R. Ausrotas, S. Dodge, H. Faulkner, I. Glendinning, A. Hays, R. Simpson, W. Swan, N. Taneja, and J. Vittek Sep. 1973 207 p refs
(Contract NASw-2412)
(NASA-CR-137373; FTL-R73-4) Avail: NTIS HC $13.50 CSCL 01C

A study was conducted to determine the demand for and the economic factors involved in air transportation in a low and medium density market. The subjects investigated are as follows: (1) industry and market structure, (2) aircraft analysis, (3) economic analysis, (4) field surveys, and (5) computer network analysis. Graphs are included to show the economic requirements and the aircraft performance characteristics. Author

N74-19652# Advisory Group for Aerospace Research and Development, Paris (France).
DESIGN AGAINST FATIGUE
Dec. 1973 122 p refs Presented at the 37th Meeting of the Structures and Mater. Panel at the Hague, Netherlands, 7-12 Oct. 1973
(AGARD-CP-141) Avail: NTIS HC $9.25

Papers presented at the conference on designing aircraft against fatigue are reported. Fatigue analysis and tests for fighter aircraft are emphasized. For individual titles, see N74-19653 through N74-19660.

N74-19653 British Aircraft Corp., Preston (England).
SOME CONSIDERATIONS OF THE INFLUENCE OF FATIGUE IN THE DESIGN OF STRIKE AIRCRAFT
A. N. Rhodes *In* AGARD Design Against Fatigue Dec. 1973 17 p (For availability see N74-19652 11-02)

After summarizing some of the factors which characterize strike aircraft with regard to their fatigue design, the types of external loading to which it will be subjected in service are considered. A consideration is also given to some of the factors which influence the choice of materials, aircraft layout and design. Qualification of the finished product is discussed, as are some of the techniques in monitoring service usage. Problem areas are highlighted. Author

N74-19654 Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany).
FATIGUE DESIGN PRACTICE
K. Ahrensdorf *In* AGARD Design Against Fatigue Dec. 1973 18 p refs (For availability see N74-19652 11-02)

To define missions for fatigue analysis, mission breakdown and to estimate load spectra for combat or tactical aircraft a high degree of guesstimating is necessary. Available data as to operational mission and load spectra during aircraft development differ greatly, on the other hand these estimated data have a considerable influence on aircraft design. For this reason the aircraft design shall be in such a way that inspections in critical regions are possible and crack propagation is noncritical between inspection intervals. In addition, on all flying aircraft cg - acceleration measurements are necessary, besides the results of full scale fatigue tests, to have available the complete information for individual life control of flying aircraft. Some aspects of the whole fatigue integrity program are discussed. Author

N74-19655 McDonnell Aircraft Co., St. Louis, Mo.
STRUCTURAL FATIGUE ANALYSIS AND TESTING FOR FIGHTER AIRCRAFT
L. F. Impellizzeri *In* AGARD Design Against Fatigue Dec. 1973 12 p refs (For availability see N74-19652 11-02)

The design of fatigue resistant structure includes a combination of fatigue testing analysis. A review of the structural design and development programs of the F-4 and F-15 aircraft highlights their spectrum fatigue testing and indicates that these tests are essential in providing a satisfactory level of structural integrity. An existing procedure is discussed which utilizes Neuber's rule and a cyclicly decaying residual stress function to continually track notch root stress-strain patterns. The technique was developed particularly to predict life for fatigue spectra with either a constant minimum stress or a constant mean stress. A modification of the technique is presented which simplifies its applicability for fatigue spectra with variable minimum and/or mean stresses. This also includes variable stress ratios. Life predictions using the modified technique are compared with spectrum test results on 7075-T6 aluminum and 6Al-4V titanium. An example is presented of crack initiation and crack growth caused by out-of-plane bending in a fighter airplane upper wing skin. The local structural detail is analyzed. Fatigue analysis in terms of crack propagation is performed based on the residual tension predicted by the elastic-plastic computer program as the crack extends. Calculated crack growth rates are compared with electron miscroscope photographs of the upper wing skin fracture surface showing striation spacings. Author

N74-19656 Grumman Aerospace Corp., Bethpage, N.Y.
FATIGUE AND FRACTURE CONSIDERATIONS FOR TACTICAL AIRCRAFT
I. G. Hedrick, L. B. Wehle, and P. D. Bell *In* AGARD Design Against Fatigue (date) 15 p refs (For availability see N74-19652

11-02)

A review of some of the practical aspects of designing against fatigue is presented. An outline is included of the latest fatigue analysis method used at Grumman and a discussion of some of the more interesting fatigue problems encountered in the evolution of several Grumman aircraft. Some new technological developments are discussed, including the F-14 electron beam welded titanium wing carry-through box. The capabilities of some special Grumman inspection techniques to improve quality are reviewed. Author

N74-19657 Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany).

FULL SCALE FATIGUE REQUIREMENTS FOR RATIONAL FATIGUE LIFE PREDICTION

H. J. Zocher *In* AGARD Design Against Fatigue Dec. 1973 14 p refs (For availability see N74-19652 11-02)

After discussing a suitable fatigue life evaluation and certification procedure, some requirements are specified for full scale fatigue testing techniques which should be mandatory for future fatigue life substantiation. Test results obtained from two full scale fatigue tests utilizing different testing procedures are compared to service failures. The fatigue test which used the proposed improved testing technique with flight-by-flight loading sequence showed much better results which were in adequate correlation with service experience. Author

N74-19658 Royal Aircraft Establishment, Farnborough (England). Structures Dept.

THE ROLE OF THE MAJOR FATIGUE TEST IN THE ACCEPTANCE, CERTIFICATION AND SAFE UTILISATION OF STRIKE AIRCRAFT

R. D. J. Maxwell *In* AGARD Design Against Fatigue Dec. 1973 8 p refs (For availability see N74-19652 11-02)

The role of the major fatigue test in acceptance, certification, and safe utilization of a strike aircraft is examined from the writing of the aircraft specification to the monitoring of life consumption in service. Attention is focussed on problems associated with defining the test load conditions and interpreting the results in terms of the monitoring system used, including the use of relevant flight load measurements. A summary of the problem areas and suggested minimum standards of fatigue testing, flight measurement and dissemination of the information are included. Author

N74-19659 National Aero- and Astronautical Research Inst., Amsterdam (Netherlands).

RE-ASSESSMENT OF FATIGUE PERFORMANCE OF FIGHTER AIRCRAFT

G. M. VanDijk *In* AGARD Design Against Fatigue Dec. 1974 19 p refs (For availability see N74-19652 11-02)

Fatigue monitoring results obtained by means of strain-gauge recordings are scrupulously compared to the reference full-scale fatigue test loading, finally yielding a relative fatigue severity index. The comparative analysis among other things highlights the importance of ground loads, counting methods and local plasticity at notch roots. A complex notch stress-strain history analysis is carried out to assess the notch root stress history and residual stresses. Finally, a simplified calculation procedure is suggested to account for notch root plasticity and residual stresses. This simplified analysis is a sufficiently accurate substitute of the complex notch stress-strain history analysis. Author

N74-19660 Societe Nationale Industrielle Aerospatiale, Paris (France).

DESIGNERS' NEED FOR GENERAL INFORMATION FROM ANALYSIS OF FATIGUE TEST RESULTS AND SERVICE BEHAVIOR

William Barrois *In* AGARD Design Against Fatigue Dec. 1973 13 p refs (For availability see N74-19652 11-02)

The requirements in fatigue assessment for designing aircraft structures are discussed in terms of interpretative computation, a priori subjective classification of fatigue strength, and prediction analysis. The analyses of fatigue behavior in tests and in service, and the standardization of test loading are discussed along with interpretation methods of fatigue test results, and the establishment of general data on fatigue strength. F.O.S.

N74-19661*# Scientific Translation Service, Santa Barbara, Calif.

TUPOLEV 144 AND CONCORDE: THE OFFICIAL PERFORMANCES ARE COMPARED FOR THE FIRST TIME

Jacques Morisset Washington NASA Apr. 1974 10 p Transl. into ENGLISH from Air et Cosmos (France), v. 11, no. 494, 8 Sep. 1973 p 22-23, 48

(Contract NASw-2483)

(NASA-TT-F-15446) Avail: NTIS HC $4.00 CSCL 01C

Preliminary Soviet data and accurate French-English flight data are used to compare the performances of the Concorde and the TU-144 in the following areas: flight profiles, takeoff weight, range, payload capability, takeoff and landing distances. Author

N74-19662# National Aeronautical Establishment, Ottawa (Ontario).

ESTIMATES OF THE LATERAL-DIRECTIONAL STABILITY DERIVATIVES OF A HELICOPTER FROM FLIGHT MEASUREMENTS

D. G. Gould and W. S. Hindson Dec. 1973 69 p refs (NRC-13882; LR-572; ISSN-0077-5541) Avail: NTIS HC $6.50

The lateral-directional stability derivatives for a medium-sized single rotor helicopter were estimated for three different forward speeds. The analysis technique is based on a least squares quasilinearization method which employs a specially formatted parameter vector so that reliable a priori estimates can be used to assist convergence. An additional unique feature is the procedure adopted to reduce the influence of unknown atmospheric inputs on the parameter estimates by means of a conglomerate analysis of several similar runs. Author

N74-19663*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

WIND TUNNEL INVESTIGATION OF A LARGE-SCALE SEMISPAN MODEL WITH AN UNSWEPT WING AND AN UPPER-SURFACE BLOWN JET FLAT

Charles C. Smith, Jr., Arthur E. Phelps, III, and W. Latham Copeland Washington Feb. 1974 146 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Hampton, Va.

(NASA-TN-D-7526; L-9137) Avail: NTIS HC $4.75 CSCL 01C

An investigation of the static longitudinal aerodynamic characteristics of a large-scale semispan model with an unswept wing and an upper-surface blown jet flap for lift augmentation was conducted in the Langley full-scale tunnel. The wing had an aspect ratio of 7.8 (3.9 for the semispan) and a simulated turbofan engine mounted ahead of and above the wing in a nacelle with a rectangular-exit nozzle. The flap system had three spanwise flap segments: (1) an inboard plain flap located behind the engine and having a large radius of curvature to provide a smooth upper surface to enhance the turning of the jet sheet, (2) a double-slotted midspan flap, and (3) a drooped aileron equipped with blowing boundary-layer control. The wing was also equipped with a full-span leading-edge Krueger flap with blowing boundary-layer control. In addition to the aerodynamic measurements, noise measurements were also included in the investigation for positions above and below the wing. Author

N74-19664*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

FORE AND AFT ELASTIC RESPONSE CHARACTERISTICS OF 34 x 9.9, TYPE 7, 14 PLY-RATING AIRCRAFT TIRES OF BIAS-PLY, BIAS-BELTED, AND RADIAL-BELTED DESIGN M.S. Thesis - George Washington Univ., May 1973

John A. Tanner Washington Apr. 1974 50 p refs (NASA-TN-D-7449; L-8350) Avail: NTIS HC $3.25 CSCL 01C

An investigation was conducted to determine the fore-and-aft elastic response characteristics of 34 x 9.9, type VII, 14 ply-rating aircraft tires of bias-ply, bias-belted, and radial-belted design. The investigation consisted of static and rolling tests on dry concrete pavements at the Langley aircraft landing loads and traction facility; statistical techniques which related the measured tire elastic characteristics to variations in the vertical load, inflation

pressure, braking force and/or tire vertical deflection; and a semiempirical analysis which related the tire elastic behavior to measured wheel slippage during steady-state braking. The bias-belted tire developed the largest spring constant value for most loading conditions; the radial-belted tire, the smallest. The elastic response of the tire free periphery to static braking included both tread stretch and carcass torsional wind-up about the axle for the bias-ply and bias-belted tires and carcass wind-up alone for the radial-belted tire. Author

N74-19665*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
WIND TUNNEL TESTS OF A FULL-SCALE MODEL OF A LIGHT TWIN-ENGINE AIRPLANE WITH FIXED AUXILIARY AIRFOIL OR LEADING-EDGE SLOT
Marvin P. Fink, James P. Shivers, and Lucy C. White Washington Apr. 1974 119 p refs
(NASA-TN-D-7474; L-9225) Avail: NTIS HC $4.50 CSCL 01C

An investigation has been conducted by means of wind-tunnel tests of a full-scale mockup of a light twin-engine airplane configuration to determine the effects of outboard partial-span slots and of auxiliary airfoils ahead of the leading edge of the wing in improving aerodynamic characteristics at high angles of attack. Both of the stall-control devices gave considerable improvement in high angle-of-attack characteristics with the auxiliary airfoil giving the more favorable results, but neither device performed as well as might have been expected. Author

N74-19666*# Techtran Corp., Silver Spring, Md.
CIVIL AVIATION IN THE USSR (THE FIFTIETH ANNIVERSARY OF ITS FORMATION)
A. F. Aksenov Washington NASA Apr. 1974 52 p ref Transl. into ENGLISH of the Russian book Moscow, Znaniye Press, 1973
(Contract NASw-2485)
(NASA-TT-F-806) Avail: NTIS HC $3.75 CSCL 01B

The history of the development of Soviet civil aviation has paralleled the burgeoning of Soviet power and influence in the 20th century. The influence of aircraft on transportation and national unity is naturally emphasized, while such valuable contributions as the transport of the sick by air, construction of buildings using helicopters, and the aerial surveying and extermination of insect pests are discussed as well. Many types of Soviet aircraft are described and compared as to size, range and other characteristics. Author

N74-19667*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SERVICE EVALUATION OF AIRCRAFT COMPOSITE STRUCTURAL COMPONENTS
William A. Brooks, Jr. and Marvin B. Dow Oct. 1973 22 p refs Presented at the 5th Natl. SAMPE Tech. Conf., Kiamesha Lake, N. Y., 9-11 Oct. 1973
(NASA-TM-X-71944; L-9024) Avail: NTIS HC $4.25 CSCL 10C

The advantages of the use of composite materials in structural applications have been identified in numerous engineering studies. Technology development programs are underway to correct known deficiencies and to provide needed improvements. However, in the final analysis, flight service programs are necessary to develop broader acceptance of, and confidence in, any new class of materials such as composites. Such flight programs, initiated by NASA Langley Research Center, are reviewed. These programs which include the selectively reinforced metal and the all-composite concepts applied to both secondary and primary aircraft structural components, are described and current status is indicated. Author

N74-19668*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY MEASUREMENT OF THE AIRFRAME NOISE FROM AN F-106B DELTA WING AIRCRAFT AT LOW FLYOVER SPEEDS
Richard R. Burley Mar. 1974 42 p refs
(NASA-TM-X-71527; E-7928) Avail: NTIS HC $5.25 CSCL 01C

To establish a realistic lower limit for the noise level of advanced supersonic transport aircraft will require knowledge concerning the amount of noise generated by the airframe itself as it moves through the air. The airframe noise level of an F-106B aircraft was determined and was compared to that predicted from an existing empirical relationship. The data were obtained from flyover and static tests conducted to determine the background noise level of the F-106B aircraft. Preliminary results indicate that the spectrum associated with airframe noise was broadband and peaked at a frequency of about 570 hertz. An existing empirical method successfully predicted the frequency where the spectrum peaked. However, the predicted OASPL value of 105 db was considerably greater than the measures value of 83 db. Author

N74-19669*# Techtran Corp., Glen Burnie, Md.
AIRCRAFT OF THE FUTURE
I. Tolztych Washington NASA Apr. 1974 10 p Transl. into ENGLISH from Tech. Oekonomische Inform. der Zivilen Luftfahrt, v. 8, no. 9, 1972 p 419-424
(Contract NASw-2485)
(NASA-TT-F-15424) Avail: NTIS HC $4.00 CSCL 01C

Evaluation of the technical and economic efficiency of the types of aircraft likely to be developed in the coming decades involves discussion of the problem of evaluating the degree of structural maturity and perfection of passenger aircraft and their economic efficiency. Problems connected with the development of increasingly high-speed subsonic aircraft, supersonic, and, ultimately, hypersonic aircraft are discussed, including engine designs, fuels, and noise reduction. In addition, the use of V/STOLs to provide more efficient transportation between airports and city centers is considered. Author

N74-19670# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
THE CONSIDERATION OF CONVECTION EFFECTS IN AERODYNAMIC SOUND GENERATION THEORY
G. Zimmerman Feb. 1974 17 p refs In GERMAN
(Ber-4/1974) Avail: NTIS HC $4.00

Lighthill's theory of aerodynamic sound generation is used to link noise intensity, radiated from a limited turbulent flow field, to a correlation tensor in the turbulent flow for the case where the turbulent flow is superimposed on a base flow. Transformations to a movable coordination system consider the turbulence effect and the convection effect. Transl by G.G.

N74-19671*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A COMPILATION AND ANALYSIS OF TYPICAL APPROACH AND LANDING DATA FOR A SIMULATOR STUDY OF AN EXTERNALLY BLOWN FLAP STOL AIRCRAFT
David B. Middleton and Hugh P. Bergeron Washington Apr. 1974 24 p refs
(NASA-TN-D-7497; L-9142) Avail: NTIS HC $3.00 CSCL 01C

A piloted simulation study has been made of typical landing approaches with an externally blown flap STOL aircraft to ascertain a realistic dispersion of parameter values at both the flare window and touchdown. The study was performed on a fixed-base simulator using standard cockpit instrumentation. Six levels of stability and control augmentation were tested during a total of 60 approaches (10 at each level). A detached supplement containing computer printouts of the flare-window and touchdown conditions for all 60 runs has been prepared. Author

N74-19672*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
FLIGHT INVESTIGATION OF APPROACH AND FLARE FROM SIMULATED BREAKOUT ALTITUDE OF A SUBSONIC JET TRANSPORT AND COMPARISON WITH ANALYTICAL MODELS
Neil W. Matheny Washington Apr. 1974 36 p refs
(NASA-TN-D-7645 ; H-803) Avail: NTIS HC $3.25 CSCL 01C

Satisfactory and optimum flare windows are defined from pilot ratings and comments. Maximum flare normal accelerations, touchdown rates of sink, and total landing maneuver time increments are summarized as a function of approach airspeed margin (with respect to reference airspeed) and flare initiation

altitude. The effects of two thrust management techniques are investigated. Comparisons are made with predictions from three analytical models and the results of a simulator study. The approach speed margin was found to have a greater influence on the flare initiation altitude than the absolute airspeed. The optimum airspeed was between the reference airspeed and the reference airspeed plus 10 knots. The optimum flare initiation altitude range for unrestricted landings was from 11 meters to 20 meters (36 feet to 66 feet), and the landing time in the optimum window was 8 seconds. The duration of the landing maneuver increased with increasing flare initiation altitude and with increasing speed margins on the approach. Author

N74-19673*# Northrop Corp., Newbury Park, Calif. Ventura Div.
INVESTIGATION OF PREDICTION METHODS FOR THE LOADS AND STRESSES OF APOLLO TYPE SPACECRAFT PARACHUTES. VOLUME 1: LOADS
F. E. Mickey, A. J. McEwan, E. G. Ewing, W. C. Huyler, Jr., and B. Khajeh-Nouri Jun. 1970 367 p refs 2 Vol.
(Contract NAS9-8131; NV Proj. 0111)
(NASA-CR-134230; NVR-6431) Avail: NTIS HC $21.50 CSCL 01B

An analysis was conducted with the objective of upgrading and improving the loads, stress, and performance prediction methods for Apollo spacecraft parachutes. The subjects considered were: (1) methods for a new theoretical approach to the parachute opening process, (2) new experimental-analytical techniques to improve the measurement of pressures, stresses, and strains in inflight parachutes, and (3) a numerical method for analyzing the dynamical behavior of rapidly loaded pilot chute risers. Author

N74-19674*# Northrop Corp., Newbury Park, Calif. Ventura Div.
INVESTIGATION OF PREDICTION METHODS FOR THE LOADS AND STRESSES OF APOLLO TYPE SPACECRAFT PARACHUTES. VOLUME 2: STRESSES
W. M. Mullins, D. T. Reynolds, K. G. Lindh, and M. R. Bottorff Jun. 1970 276 p refs
(Contract NAS9-8131; NV Proj. 0111)
(NASA-CR-134231; NVR-6432) Avail: NTIS HC $17.00 CSCL 01B

For abstract, see N74-19673.

N74-19675# PPG Industries, Inc., Creighton, Pa. Aircraft and Specialty Products.
DEVELOPMENT OF DESIGN, TEST, AND ACCEPTANCE CRITERIA FOR ARMY HELICOPTER TRANSPARENT ENCLOSURES Final Report
Leonard M. Cook, Glenn E. Freeman, Rudy L. Malobicky, and C. Robert Lang Sep. 1973 246 p refs
(Contract DAAJ02-72-C-0073; DA Proj. 1F1-62205-A-119)
(AD-772936; USAAMRDL-TR-73-65) Avail: NTIS CSCL 01/3

Because of the U.S. Army's growing concern for the high frequency of transparency replacement, a program to improve the overall reliability and maintainability of helicopter transparencies by appropriate development of design, test, and acceptance criteria was conducted. Analysis of all available specifications for windshields indicated that wiper abrasion resistance is seldom specified whereas heating requirements are always addressed. Military specifications for windshields and some other parts are lacking, and actual qualification tests for finished products are incomplete. The developed specification attempts to correct this inadequacy by proposing a complete document that is applicable for all transparencies on current and near-future rotary-wing aircraft. Bird impact tests of current and some potential windshield designs indicate that present glass-laminates and 1/4-inch stretched acrylic do not have a strike resistance beyond 100 mph, whereas the use of polycarbonate achieves a resistance at a speed of at least 200 mph. (Modified author abstract) GRA

N74-19676# Army Engineer Topographic Labs., Fort Belvoir, Va.
STUDIES OF THE ARMY AVIATION (V/STOL) ENVIRONMENT. REPORT NO. 9: CLASSIFICATION AND WORLD DISTRIBUTION OF VEGETATION RELATIVE TO V/STOL AIRCRAFT OPERATIONS Special Final Report
William C. Robison and John Viletto, Jr. Dec. 1973 35 p refs
(DA Proj. 1F1-62203-A-119)
(AD-773734; ETL-SR-74-4) Avail: NTIS CSCL 01/1

The ability of V/STOL aircraft to land on or take off from unprepared sites is greatly affected by the vegetation of a locality. Dense forests make normal landings impossible, but they can provide a cushion in the event of a crash landing. Sites with fewer trees may be used for landings and takeoffs but may offer hazards from deadfall, protruding trees, fire, or airborne litter. Other vegetation types involve few direct hazards to aviation but may conceal bodies of water, present seasonal fire hazards, or have specialized growth forms (such as cacti) that impede landings. Considered from the point of view of effects on the operation of V/STOL aircraft, vegetation can be classified into nine formation-classes: closed forest, open forest and woodland, savanna, treeless grassland, closed shrubs, sparse woodland and scrub, vegetation sparse to absent (without trees), aquatic vegetation, and cultivated vegetation with short planting cycles. (Modified author abstract) GRA

N74-19677# Cornell Univ., Ithaca, N.Y.
RESEARCH ON HELICOPTER NOISE Final Report, 25 Jun. 1970 - 1 Oct. 1973
William R. Sears 1974 7 p refs
(Contract DAHC04-70-C-0057; DA Proj. DO1-61102-B-33G)
(AD-773385; AROD-9372-3-F) Avail: NTIS CSCL 01/1

The report summarizes research on helicopter noise under the following headings: Broadband noise; high-speed blade slap; and noise related to blade accelerations. GRA

N74-19678# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DETERMINATION OF THE FORCES IN THE KINEMATIC PAIRS OF A LANDING GEAR MECHANISM
I. M. Mitryaev 15 Jan. 1974 12 p Transl. into ENGLISH from Tr. Prikl. Mekh. (USSR), no. 95, 1968 p 26-30
(AF Proj. 1369)
(AD-773877; FTD-HT-23-789-74) Avail: NTIS CSCL 01/3

The report examines the mechanical forces exerted on the linked members of a landing gear mechanism. GRA

N74-19679# Sacramento Air Materiel Area, McClellan AFB, Calif. Joint Technical Coordinating Group for Air Launched Non-Nuclear Ordnance.
AIRCRAFT/STORES COMPATIBILITY SYMPOSIUM PROCEEDINGS, VOLUME 1
20 Sep. 1973 261 p refs Conf. held at Sacramento, Calif., 18-20 Sep. 1973
(AD-773813; JTCG/ALNNO-WP-12-2-Vol-1) Avail: NTIS CSCL 01/3

The report contains the proceedings of and technical papers presented at the Aircraft/Stores Compatibility Symposium, held at the Woodlake Inn, Sacramento, California on 18-20 September 1973. In addition, it contains several other technical papers prepared for the symposium but which were not presented. The purpose of the symposium was to bring together the technical expertise within Government and industry throughout the world to review and discuss compatibility developments and experiences. GRA

N74-19680# Sacramento Air Materiel Area, McClellan AFB, Calif. Joint Technical Coordinating Group for Air Launched Non-Nuclear Ordnance.
AIRCRAFT/STORES COMPATIBILITY SYMPOSIUM PROCEEDINGS, VOLUME 3
20 Sep. 1973 325 p refs Conf. held at Sacramento, Calif., 18-20 Sep. 1973
(AD-773815; JTCG/ALNNO-WP-12-2-Vol-3) Avail: NTIS CSCL 01/3

Contents: A study of the SUU-51A/B dispenser munition's high speed saturation problem and proposed solutions; Separation prediction of small electronic sensors from aircraft; A parametric/sensitivity study of store separation; Conformal carriage separation program; On safe separation criteria for external stores and pilot escape capsules (III); Effects of aircraft maneuver and jettison of pylon with stores; A parametric method of aerodynamic flow

field presentation; An estimate of the effect of MER structural dynamics on store separation; Harpoon/P-3 Orion separation program; Store installed drag measurement and test techniques for improved resolution; Flight demonstrated performance improvements with conformal weapons. GRA

N74-19681# Sacramento Air Materiel Area, McClellan AFB, Calif. Joint Technical Coordinating Group for Air Launched Non-Nuclear Ordnance.
AIRCRAFT/STORES COMPATIBILITY SYMPOSIUM PROCEEDINGS, VOLUME 4
20 Sep. 1973 352 p refs Conf. held at Sacramento, Calif., 18-20 Sep. 1973
(AD-773816; JTCG/ALNNO-WP-12-2-Vol-4) Avail: NTIS CSCL 01/3

Contents: An inflight investigation of the influence of stability and control parameters on weapon delivery accuracy; External store effects on the stability of fighter and interceptor airplanes; Potential application of active flutter suppression to future fighter attack aircraft; Nondestructive environmental testing for improved reliability in advanced development programs; A new approach for rapid flutter clearance of aircraft with external stores; An investigation of factors affecting the accuracy of the captive trajectory wind tunnel technique; A computer aided technique for determining aircraft/stores electrical interface requirements; Image system solution for mutual aerodynamic interface; A history of AV-8A (Harrier) weapon compatibility trials; Thermal considerations of stores in captive flight; Wind tunnel heating test of aircraft stores. GRA

N74-19682# Battelle Columbus Labs., Ohio. Tactical Technology Center.
BALLONET GAS MOTION IN LARGE BALLOONS: MODEL DESIGN AND EXPERIMENTS
Charles F. Holt Sep. 1973 73 p refs
(Contract DAAH01-72-C-0982)
(AD-773395) Avail: NTIS CSCL 01/3

The report presents model-scaling criteria by which a phenomenon such as ballonet slosh may be studied and to present the results of such an experiment with a 1/30 scale model of the ARPA Family 2 balloon. GRA

N74-19683# Boeing Aerospace Co., Seattle, Wash. Research and Engineering Div.
INTEGRATED LIFE SUPPORT SYSTEM: DESIGN STUDY MEDIUM STOL TRANSPORT Final Technical Report, Oct. 1971 - Mar. 1973
Wolf J. Hebenstreit, Wayne A. Berge, Roland K. Moir, Milton S. Worley et al Jul. 1973 327 p refs
(Contract F33657-72-C-0312; AF Proj. 412A)
(AD-773589; D180-14203A 1; ASD-TR-73-29) Avail: NTIS CSCL 01/3

The report contains the summary of all requirements analyses, concept developments, trade study results and final design data developed for an integrated life support system for 2 medium STOL aircraft. The effort was directed towards integrating all requirements into a design which has specifically tailored towards the missions, operational environments and human demands present in the system. Requirements were identified and translated into multiple design concepts which were evaluated and screened for trade study analysis. From the trade study analysis a final configuration was selected and documented in appropriate specifications. Author (GRA)

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INVESTIGATION OF ADVANCED STRUCTURAL CONCEPTS FOR FUSELAGE Final Report
Robert J. Mayerjak and William A. Smyth Oct. 1973 148 p refs
(Contract DAAJ02-72-C-0057; DA Proj. 1F1-62208-A-170)
(AD-773597; R-1164; USAAMRDL-TR-73-72) Avail: NTIS CSCL 01/3

Design concepts are presented and evaluated for the application of fiber reinforced composite materials to fuselage structures. The concepts are evaluated on the basis of cost-effectiveness and performance when specifically applied to the aft fuselage of the Army AH-1G helicopter. Comparisons to the existing metal structure show that several of the new concepts provide significant advantages in initial acquisition cost, life-cycle cost, weight, safety, reliability, and maintainability. Author (GRA)

N74-19685# Adaptronics, Inc., McLean, Va.
RPV(REMOTELY PILOTED VEHICLE)/SELF-ORGANIZING CONTROL DEMONSTRATION SYSTEM. VOLUME 1: SOC EQUATION DEVELOPMENT, LOGIC CONFIGURATIONS, AND CONTROL MODES Final Technical Report, 1 Mar. 1972 - 31 Aug. 1973
D. Cleveland, Roger L. Barron, and Lewey O. Gilstrap, Jr. Wright-Patterson AFB, Ohio AMRL Dec. 1973 70 p refs
(Contract F33615-72-C-1816; AF Proj. 7233)
(AD-773860; AMRL-TR-73-66-Vol-1) Avail: NTIS CSCL 12/1

Self-Organizing control is a form of adaptive control in which the controller uses an incremental model of the plant and identifies parameters in this model by means of calculations based upon recent-term plant excitation and response histories. The report presents the theoretical derivation of refinements in self-organizing control techniques yielding substantial reduction of sampling rates of self-organizing controllers and identification of magnitudes as well as polarities of plant gain parameters. Additionally, this report describes the implementation of self-organizing controller logic in the form of breadboard digital hardware. (Modified author abstract) GRA

N74-19686# United Aircraft Corp., Stratford, Conn. Sikorsky Aircraft Div.
CH 54A DESIGN AND OPERATIONAL FLIGHT LOADS STUDY
A. L. Mongillo, Jr. and S. M. Johnson Nov. 1973 79 p refs
(Contract DAAJ02-72-C-0060; DA Proj. 1F1-62204-AA-82)
(AD-773551; SER-64370; USAAMRDL-TR-73-39) Avail: NTIS CSCL 01/3

An analytical and correlation study of predicted fatigue design data and operational flight loads data for crane-type helicopters was conducted to compare operational mission profiles with a design mission profile and to provide data for use in establishing structural design criteria for future Army helicopters. Flight loads and usage data for CH-54A helicopters operating in Southeast Asia were compared with CH-54A design data. The effects of gross weight and altitude on true airspeed were determined. Fatigue spectra were developed for six dynamic components, and fatigue lives were calculated for these components. These fatigue lives were compared with lives predicted during CH-54A design. Service histories for these components were reviewed, and it was found that none of the changes made in these components resulted from load conditions. Peak operational load parameters were compared with limit static design values. Recommendations were then developed to assist in establishing future crane helicopter fatigue design criteria. Author (GRA)

N74-19687# Army Electronics Command, Fort Monmouth, N.J.
PREFLIGHT TEST SIMULATION OF SUPERIMPOSED INTEGRATED TRAJECTORY ERROR DISPLAYS
Chris Tsoubanos and Robert Covington Jan. 1974 63 p refs
(AD-773823; ECOM-4184) Avail: NTIS CSCL 01/2

The report describes a man-machine simulation of an image display (TV video terrain image) enhanced by the superposition of symbology conveying quantitative information. A hierarchy of symbolic displays with increasing information content superimposed on a TV video terrain image is developed as an aid in approach and in precision hover. The most sophisticated configuration required ground position information. To obtain ground position information, a position sensor which utilized a ground beacon radio such as the Electronic Location Finder (ELF) was simulated. The position information was shown to be necessary to obtain hover precision of less than five feet. Aircraft stabilization equipment (ASE) was also found necessary. Author (GRA)

N74-19688# Mississippi State Univ., State College. Dept. of Aerophysics and Aerospace Engineering.
RESEARCH IN THE AREA OF THE AERODYNAMICS OF ROTORS AND PROPELLERS Final Report

altitude. The effects of two thrust management techniques are investigated. Comparisons are made with predictions from three analytical models and the results of a simulator study. The approach speed margin was found to have a greater influence on the flare initiation altitude than the absolute airspeed. The optimum airspeed was between the reference airspeed and the reference airspeed plus 10 knots. The optimum flare initiation altitude range for unrestricted landings was from 11 meters to 20 meters (36 feet to 66 feet), and the landing time in the optimum window was 8 seconds. The duration of the landing maneuver increased with increasing flare initiation altitude and with increasing speed margins on the approach. Author

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(Contract DAAJ02-72-C-0060; DA Proj. 1F1-62204-AA-82)
(AD-773551; SER-64370; USAAMRDL-TR-73-39) Avail: NTIS CSCL 01/3

An analytical and correlation study of predicted fatigue design data and operational flight loads data for crane-type helicopters was conducted to compare operational mission profiles with a design mission profile and to provide data for use in establishing structural design criteria for future Army helicopters. Flight loads and usage data for CH-54A helicopters operating in Southeast Asia were compared with CH-54A design data. The effects of gross weight and altitude on true airspeed were determined. Fatigue spectra were developed for six dynamic components, and fatigue lives were calculated for these components. These fatigue lives were compared with lives predicted during CH-54A design. Service histories for these components were reviewed, and it was found that none of the changes made in these components resulted from load conditions. Peak operational load parameters were compared with limit static design values. Recommendations were then developed to assist in establishing future crane helicopter fatigue design criteria. Author (GRA)

N74-19687# Army Electronics Command, Fort Monmouth, N.J.
PREFLIGHT TEST SIMULATION OF SUPERIMPOSED INTEGRATED TRAJECTORY ERROR DISPLAYS
Chris Tsoubanos and Robert Covington Jan. 1974 63 p refs
(AD-773823; ECOM-4184) Avail: NTIS CSCL 01/2

The report describes a man-machine simulation of an image display (TV video terrain image) enhanced by the superposition of symbology conveying quantitative information. A hierarchy of symbolic displays with increasing information content superimposed on a TV video terrain image is developed as an aid in approach and in precision hover. The most sophisticated configuration required ground position information. To obtain ground position information, a position sensor which utilized a ground beacon radio such as the Electronic Location Finder (ELF) was simulated. The position information was shown to be necessary to obtain hover precision of less than five feet. Aircraft stabilization equipment (ASE) was also found necessary. Author (GRA)

N74-19688# Mississippi State Univ., State College. Dept. of Aerophysics and Aerospace Engineering.
RESEARCH IN THE AREA OF THE AERODYNAMICS OF ROTORS AND PROPELLERS Final Report

Charles B. Cliett, Joe F. Thompson, Zahir U. A. Warsi, and Donald W. Boatwright 31 Jan. 1974 39 p refs
(Contract DAHC04-68-C-0003)
(AROD-T-3-23-E; AD-773617; EIRS-ASE-74-3) Avail: NTIS CSCL 01/1

In the report references are made to journal articles, papers, and technical reports where the results are reported. Major subject areas are: laminar boundary layers on rotating blades, unsteady boundary layers, turbulent boundary layers, numerical solution of Navier-Stokes equations for two-dimensional and three-dimensional applications, a new boyd-fitted coordinate system for numerical solution of Navier-Stokes equations, wake geometry of a hovering rotor, inflow and wake studies of a full-scale hovering rotor, the design of airfoils for low Reynolds numbering applications, rotary wing noise generation, and downwash and trailing vorticity behind high-lift wings. (Modified author abstract) GRA

N74-19689# Human Engineering Labs., Aberdeen Proving Ground, Md.
A DESIGN STUDY TO STANDARDIZE COLLECTIVE-STICK CONTROLS IN US ARMY HELICOPTERS: A HUMAN FACTORS ENGINEERING (HFE) EVALUATION
Harry R. Stowell and Clarence A. Fry Oct. 1973 82 p refs
(AD-773688; HEL-TM-24-73) Avail: NTIS CSCL 01/3

The design study was conducted by HEL to standardize collective-stick controls in U.S. Army helicopters. The objective was to formulate a standard which will specify functions and arrangement of switches on collective-stick controls in Army helicopters. Two types of collective-stick controls were developed to meet requirements in all categories of helicopters designed for the U.S. Army. A human factors engineering (HFE) evaluation was done by HEL on functional hard mock-up models representing the general design configuration developed for standardization of collective-stick controls. Results of the HFE test indicate that the configurations developed for standardization is suitable for developing airworthy designs for flight test. Author (GRA)

N74-19690# Douglas Aircraft Co., Inc., Long Beach, Calif.
THE POWER PROFILE - A NEW TYPE OF AIRFOIL Technical Report, Apr. 1972 - Nov. 1973
A. M. O. Smith and J. A. Thelander Jan. 1974 88 p refs
(Contract N00014-71-C-0250; NR Proj. 212-418)
(AD-773655; MDC-J6236) Avail: NTIS CSCL 01/3

A new concept in airfoils, termed power profiles, having a blunt trailing edge shape with two wall jets near the trailing edge is presented. The replacement of streamlining with properly designed blowing is used to prevent flow separation and additionally offers potential applications as a powered high-lift system, propulsive system, or low inertia control device. Exploratory wind tunnel tests of a 22.5% thick, 24-inch chord model with several control shapes were conducted and summarized. With high blowing (power mode) lift coefficients in excess of 8.0 were obtained, and with a very small amount of blowing (boundary layer control mode) unseparated flow and low drag was achieved. In the latter case blowing can be accomplished by natural ram air pressure and might serve as a substitute for streamlining. Applications of this concept and areas for additional study are outlined. Author (GRA)

N74-19691# Army Aviation Systems Command, St. Louis, Mo.
MAJOR ITEM SPECIAL STUDY (MISS), CH-47A ROTARY WING HEAD FWD Interim Report, Jan. 1964 - Jul. 1973
Jan. 1974 24 p
(AD-773718; USAAVSCOM-TR-73-32) Avail: NTIS CSCL 01/3

The report is designed to illustrate cost savings which would result from specific efforts in the areas of product improvement in quality and design. For the purpose of this study the cost savings produced in the area of product improvement are based on total elimination of a certain failure mode or modes. Appropriate modes are chosen because of their proportion of the total removals or their proportion in combination with other similar modes. These eliminated removals are then assumed to follow the distribution of the remaining removal modes. The actual cost savings are determined from the increase in the mean time to removal based on the new removal distributions. GRA

N74-20407 Royal Aircraft Establishment, Bedford (England).
A THEORETICAL AND EXPERIMENTAL INVESTIGATION OF THE EXTERNAL-FLOW, JET-AUGMENTED FLAP
P. R. Ashill *In* AGARD V/STOL Propulsion Systems Jan. 1974 18 p refs (For availability see N74-20401 11-28)

N74-20411 Societe Nationale Industrielle Aerospatiale, Paris (France).
SHORT HAUL AIRCRAFT ADAPTATION TO THE USE OF SHORT LANDING FIELDS [ADAPTATION MOTEURS-CELLULE DES AVIONS COURTS COURRIERS UTILISANT DES PISTES COURTES]
Pierre Guyot *In* AGARD V/STOL Propulsion Systems Jan. 1974 11 p In FRENCH (For availability see N74-20401 11-28)

N74-20413 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany).
AERODYNAMIC INTERFERENCE BETWEEN FUSELAGE AND LIFTING JETS EMERGING FROM ITS LOWER PART
G. Viehweger *In* AGARD V/STOL Propulsion Systems Jan. 1974 14 p refs (For availability see N74-20401 11-28)

N74-20414 Army Air Mobility Research and Development Lab., Fort Eustis, Va.
RESEARCH TOWARD DEVELOPMENT FEASIBILITY OF AN ADVANCED TECHNOLOGY V/STOL PROPELLER SYSTEM
James Gomez, Jr. and Robert M. Levintan *In* AGARD V/STOL Propulsion Systems Jan. 1974 12 p refs Prepared in cooperation with Hamilton Standard Div., United Aircraft Corp., Windsor Locks, Conn. (For availability see N74-20401 11-28)

N74-20416* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INTEGRATED PROPULSION/ENERGY TRANSFER CONTROL SYSTEMS FOR LIFT-FAN V/STOL AIRCRAFT
Wallace H. Deckert and L. Stewart Rolls *In* AGARD V/STOL Propulsion Systems Jan. 1974 8 p refs (For availability see N74-20401 11-28)

N74-20420 National Research Council of Canada, Ottawa (Ontario). Gas Dynamics Lab.
THRUST PERFORMANCE OF PODDED LIFT-FANS IN CROSSFLOW
R. A. Tyler and R. G. Williamson *In* AGARD V/STOL Propulsion Systems Jan. 1974 14 p refs (For availability see N74-20401 11-28)

N74-20421 National Gas Turbine Establishment, Pyestock (England).
SOME ENGINE AND AIRCRAFT DESIGN CONSIDERATIONS AFFECTING NOISE
D. R. Higton and T. A. Cook (Roy. Aircraft Estab., Farnborough, Engl.) *In* AGARD V/STOL Propulsion Systems Jan. 1974 9 p ref Prepared in cooperation with Roy. Aircraft Estab., Farnborough, Engl. (For availability see N74-20401 11-28)

N74-20425 National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.
AERODYNAMIC CHARACTERISTICS OF AN EXPERIMENTAL LIFTING FAN UNDER CROSSFLOW CONDITIONS
U. W. Schaub *In* AGARD V/STOL Propulsion Systems Jan. 1974 16 p refs (For availability see N74-20401 11-28)

N74-20426 National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.
NOISE CHARACTERISTICS OF AN EXPERIMENTAL LIFTING FAN UNDER CROSSFLOW CONDITIONS
G. Krishnappa *In* AGARD V/STOL Propulsion Systems Jan. 1974 14 p refs (For availability see N74-20401 11-28)

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines, hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; Nuclear Engineering; and 28 Propulsion Systems.

N74-19692* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
METHOD OF MAKING POROUS CONDUCTIVE SUPPORTS FOR ELECTRODES Patent
Glenn R. Schaer, inventor (to NASA) (Battelle Memorial Inst., Columbus, Ohio) Issued 18 Sep. 1973 6 p Filed 22 Mar. 1972 Sponsored by NASA
(NASA-Case-GSC-11367-1; US-Patent-3,759,747; US-Patent-Appl-SN-236985; US-Patent-Class-136-36) Avail: US Patent Office CSCL 10C

Porous conductive supports for electrochemical cell electrodes are made by electroforming thin corrugated nickel foil, and by stacking pieces of the corrugated foil alternatively with pieces of thin flat nickel foil. Corrugations in successive corrugated pieces are oriented at different angles. Adjacent pieces of foil are bonded by heating in a hydrogen atmosphere and then cutting the stack in planes perpendicular to the foils.
Official Gazette of the U.S. Patent Office

N74-19693* National Aeronautics and Space Administration. Pasadena Office, Calif.
STORAGE BATTERY COMPRISING NEGATIVE PLATES OF A WEDGE SHAPED CONFIGURATION Patent
Richard S. Bogner (ESB, Inc., Raleigh, N. C.) and Charles D. Farris, inventors (to NASA) (ESB, Inc., Raleigh, N. C.) Issued 5 Feb. 1974 6 p Filed 22 Feb. 1972 Supersedes N72-22048 (10 - 13, p 1695) Sponsored by NASA Prepared for JPL
(NASA-Case-NPO-11806-1; US-Patent-3,790,409; US-Patent-Appl-SN-228163; US-Patent-Class-136-20; US-Patent-Class-136-30) Avail: US Patent Office CSCL 10C

An improved silver-zinc battery particularly suited for use in an environment where battery operation is subjected to multiple charge/discharge cycling over extended periods is described. The battery seperator system, containing a highly absorbent material continguous with the surfaces of the plates and multiple semi-permeable membranes interposed between the plates, is also characterized. Official Gazette of the U.S. Patent Office

N74-19694 Escher Technology Associates, St. Johns, Mich.
A PROBLEM STATEMENT: OCEAN BASED SOLAR-TO-HYDROGEN ENERGY CONVERSION MACRO SYSTEM
William J. D. Escher and Joe A. Hanson (Oceanic Inst.) Nov. 1973 25 p refs
Copyright. Avail: Issuing Activity CSCL 10A

An ocean based solar to hydrogen energy conversion facility is proposed that uses hydrogen as an energy carrier to be delivered to the spectrum of the energy using sector, instead of electricity, because of hydrogen's advantages of transportability and storability. The solar to hydrogen conversion process is conducted on the open ocean, and not in the traditional desert location. A number of coproducts that can also be supplied by the proposed ocean complex includes sea foods, salts, fertilizers, magnesium, and aluminum materials. Author

N74-19695 Oregon State Univ., Corvallis.
OPTIMIZATION OF STAGED RANKINE ENERGY CONVERSION CYCLES FOR HIGH EFFICIENCY Ph.D. Thesis
Larry Dean Simmons 1974 183 p
Avail: Univ. Microfilms Order No. 74-4206

The potential of staged Rankine cycle systems for substantially higher efficiency was studied. It was necessary to optimize the cycles to determine maximum potential efficiency, and the sequential unconstrained minimization technique of nonlinear programming was implemented on the CDC 3300 computer for this purpose. Binary, ternary, and quaternary Rankine cycle configurations were optimized for maximum efficiency under a set of realistic constraints. Liquid metal working fluids were used for the higher temperature stages with water for the low temperature stage fluid. Maximum efficiencies are presented for the best cycle configurations with peak temperatures from 900 F to 3000 F. Sensitivity of the results to certain critical assumptions is also included. Dissert. Abstr.

N74-19696*# Florida Univ., Gainesville. Engineering and Industrial Experiment Station.
MASS TRANSFER IN FUEL CELLS Semiannual report, 1 Mar - 31 Aug. 1973
Robert D. Walker, Jr. 14 Dec. 1973 93 p refs
(Grant NGL-10-005-022)
(NASA-CR-137359; SAR-16) Avail: NTIS HC $7.75 CSCL 10B

Developments in the following areas are reported: surface area and pore size distribution in electrolyte matrices, electron microscopy of electrolyte matrices, surface tension of KOH solutions, water transport in fuel cells, and effectiveness factors for fuel cell components. Author

N74-19697*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NASA LEWIS H2-O2 MHD PROGRAM
Marlin Smith, L. D. Nichols, and G. R. Seikel 10 Apr. 1974 8 p refs Presented at the 14th Symp. on Eng. Aspects of Magnetohydrodynamics, Tullahoma, Tenn., 8-10 Apr. 1974
(NASA-TM-X-71520; E-7907) Avail: NTIS HC $4.00 CSCL 10A

Performance and power costs of H2-O2 combustion powered steam-MHD central power systems are estimated. Hydrogen gas is assumed to be transmitted by pipe from a remote coal gasifier into the city and converted to electricity in a steam MHD plant having an integral gaseous oxygen plant. These steam MHD systems appear to offer an attractive alternative to both in-city clean fueled conventional steam power plants and to remote coal fired power plants with underground electric transmission into the city. Status and plans are outlined for an experimental evaluation of H2-O2 combustion-driven MHD power generators at NASA Lewis Research Center. Author

N74-19698*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
OPTICAL PROPERTIES OF THIN GOLD FILMS APPLIED TO SCHOTTKY BARRIER SOLAR CELLS
Y. -C. M. Yeh 15 Mar. 1974 22 p refs
(Contract NAS7-100)
(NASA-CR-137981; JPL-TM-33-676) Avail: NTIS HC $4.25 CSCL 10A

The Schottky barrier solar cell is considered a possible candidate for converting solar to electrical energy both for space and terrestrial applications. Knowledge of the optical constants of the ultrathin metal film used in the cell is essential for analyzing and designing higher efficiency Schottky barrier cells. The optical constants of 7.5 -nm (75-A) gold films on gallium arsenide have been obtained. In addition, the absolute collection efficiency of Schottky barrier solar cells has been determined from measured spectral response and optical constants of the gold film. Author

N74-19699# City of St. Louis, Mo.
ENERGY RECOVERY FROM WASTE: SOLID WASTE AS SUPPLEMENTARY FUEL IN POWER PLANT BOILERS Interim Report
Robert A. Lowe 1973 29 p refs
(Grant EPA-S-802255)
(SW-36d.ii; IR-2) Avail: SOD HC $0.40

The process of converting municipal solid waste into energy for power plant boilers is described. The process involves collecting the waste from residential areas, grinding the material, and air-classifying the shredded wastes to find the light combustible fraction. Magnetic metals are recovered from the heavier, mostly noncombustible, wastes. Other topics of discussion include: the processing system and its operation; boiler modification and operating experience; air pollution considerations; markets; and economics. K.M.M.

N74-19700*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A PANEL FOR SELECTIVELY ABSORBING SOLAR THERMAL ENERGY AND THE METHOD FOR MANUFACTURING THE PANEL Patent Application

James R. Lowery, inventor (to NASA) Filed 5 Apr. 1974 21 p
(NASA-Case-MFS-22562-1; US-Patent-Appl-SN-458484) Avail: NTIS HC $4.25 CSCL 10A

A panel for selectively absorbing solar thermal energy is reported that consists of a metallic substrate, a layer of bright metallic material carried on the substrate, and a solar thermal energy absorbing coating carried on the bright metallic material. A layer of zinc is interposed between the metal substrate and the layer of bright material, or the metallic substrate can be anodized for receiving the layer of bright metallic material. Also disclosed is the method for producing the coating which selectively absorbs solar thermal energy. NASA

N74-19701*# National Aeronautics and Space Administration. Pasadena Office, Calif.
HEAT OPERATED CRYOGENIC ELECTRICAL GENERATOR Patent Application
Taylor G. Wang (JPL), Melvin M. Saffre, and Daniel D. Elleman, inventors (to NASA) Filed 1 Apr. 1974 19 p
(Contract NAS7-100)
(NASA-Case-NPO-13303-1; US-Patent-Appl-SN-457295) Avail: NTIS HC $4.00 CSCL 10A

An electrical generator useful for providing electrical power in deep space, is disclosed. The generator utilizes liquid helium conversion to and from a superfluid state to cause opposite directions of rotary motion for a rotor cell to move a magnetic field provided by a changed superconductive coil mounted on the exterior of the cell. An electrical conductor interacts with the moving magnetic field provided by the superconductive coil and thereby generates electrical energy. A heat control arrangement causes the liquid helium to be partially converted to and from a superfluid state. NASA

N74-19702*# National Aeronautics and Space Administration. Pasadena Office, Calif.
ELECTRIC POWER GENERATION SYSTEM DIRECTLY FROM LASER POWER Patent Application
Katsunori Shimada, inventor (to NASA) (JPL) Filed 27 Mar. 1974 17 p
(Contract NAS7-100)
(NASA-Case-NPO-13308-1; US-Patent-Appl-SN-455164) Avail: NTIS HC $4.00 CSCL 10A

A system is reported in which laser power is directly converted into electric power. Liquid cesium is ionized by a laser beam with a collector spaced apart from the cesium to collect either the cesium ions or free electrons; thus, a potential difference between the collector and the cesium liquid is produced. NASA

N74-19703*# Naval Ammunition Depot, Crane, Ind. Quality Evaluation and Engineering Lab.
EVALUATION PROGRAM FOR SECONDARY SPACECRAFT CELLS: INITIAL EVALUATION TESTS OF GENERAL ELECTRIC COMPANY 6.0 AMPERE HOUR NICKEL-CADMIUM SPACECRAFT CELLS WITH AUXILIARY ELECTRODES FOR THE ATMOSPHERIC EXPLORER SATELLITE C AND D
J. D. Harkness 2 Jan. 1974 25 p
(NASA Order S-23404-G)
(NASA-CR-138985; QEEL/C-74-1) Avail: NTIS HC $4.25 CSCL 10A

The capacity of the cells ranged from 6.6 to 7.6 ampere hours during the three capacity tests. No voltage requirements or limits were exceeded during any portion of the test. All cells recovered to a voltage in excess of 1.193 volts during the 24-hour open-circuit portion of the internal short test. All the cells reached a pressure of 20 psia before reaching the voltage limit of 1.550 volts during the pressure versus capacity test. The average ampere/hours in and voltages at this pressure were 9.1 and 1.513, respectively. All cells exhibited pressure decay in the range of 1 to 5 psia during the last 30 minutes of the 1-hour open circuit stand. Average capacity out was 7.2 ampere/hours. Author

N74-19704*# General Electric Co., Erie, Pa. Aircraft Equipment Div.
DETERMINATION OF LIFE FOR A POLYIMIDE-EPOXY ALTERNATOR INSULATION SYSTEM Final Report
W. B. Penn, R. F. Schaefer, and R. L. Balke 4 Mar. 1974 164 p refs
(Contract NAS3-15691)
(NASA-CR-134600) Avail: NTIS HC $11.25 CSCL 10B

Tests were conducted to predict remaining electrical insulation life of a polyimide epoxy insulated 60 KW, 208 volt homopolar inductor alternator, following completion of 23,130 hours of turbo-alternator endurance tests. The sectioned armature winding of this alternator stator was used as means to evaluate and measure end-life at several aging temperatures for development of an Arrhenius plot. A one-half life rate of 11.3 C was established from these data with a predicted remaining life of 60,000 hours at an armature winding temperature of 248 C and a total life, including endurance test time, of 61,645 hours. Author

N74-19705*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STATUS OF WIND-ENERGY CONVERSION
Robert L. Thomas and Joseph M. Savino 1973 9 p refs Presented at the RANN Symp., Washington, D. C., 18-20 Nov. 1973; sponsored by NSF
(NASA-TM-X-71523; E-7912) Avail: NTIS HC $4.00 CSCL 10A

The utilization of wind energy is technically feasible as evidenced by the many past demonstrations of wind generators. The cost of energy from the wind has been high compared to fossil fuel systems; a sustained development effort is needed to obtain economical systems. The variability of the wind makes it an unreliable source on a short term basis. However, the effects of this variability can be reduced by storage systems or connecting wind generators to: (1) fossil fuel systems; (2) hydroelectric systems; or (3) dispersing them throughout a large grid network. Wind energy appears to have the potential to meet a significant amount of our energy needs. Author

N74-19706*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CLEAN FUELS FROM BIOMASS
Y. Y. Hsu 1974 23 p refs Presented at the 10th Southeastern Seminar on Thermal Sci., New Orleans, 11-12 Apr. 1974
(NASA-TM-X-71538; E-7945) Avail: NTIS HC $4.25 CSCL 20M

The feasibility of converting biomass to portable fuels is studied. Since plants synthesize biomass from H2O and CO2 with the help of solar energy, the conversion methods of pyrolysis, anaerobic fermentation, and hydrogenation are considered. Cost reduction methods and cost effectiveness are emphasized. G.G.

N74-19707*# Kanner (Leo) Associates, Redwood City, Calif.
SYNCHRONOUS-FLOW GENERATOR
S. V. Zweygbergk Washington NASA Apr. 1974 8 p Transl. into ENGLISH of "Synkronflode-Generator", Chalmers Tech. Univ., Inst. for the Study of Elec. Machinery, Goteborg, Sweden, 16 Jan. 1974 2 p
(Contract NASw-2481)
(NASA-TT-F-15440) Avail: NTIS HC $4.00 CSCL 10A

A synchronous flow generator is described. The results obtained from an investigation into direct frequency reversal with the aid of semiconductors have been used as a basis for designing a synchronous-flow generator. Its uses are foreseen as reserve power plants for hospitals, power supplies on large ships, etc. Author

N74-19708*# Kanner (Leo) Associates, Redwood City, Calif.
ANALYSIS OF THE POSSIBLE USE OF WIND POWER IN SWEDEN. PART 1: WIND POWER RESOURCES, THEORY OF WIND-POWER MACHINES, PRELIMINARY MODEL 1 AND 10 MW WIND GENERATORS
Bengt Soedergard Washington NASA Apr. 1974 55 p refs Transl. into ENGLISH of "Utredning om Vindkraftens Moejligheter i Sverige. Etapp 1: Vindkraftresurser - Teori foer Vindkraftmaskiner - Preliminaera Vindgeneratormopeller 1 och 10 MW", Swed. Board for Tech. Develop., report, 18 Dec. 1973 44 p
(Contract NASw-2481)
(NASA-TT-F-15441) Avail: NTIS HC $5.75 CSCL 10A

Aspects are discussed that must be considered in respect to the possible use of wind power in Sweden; such as availability

and nature of wind resources, cost of this type of energy, etc. The basic theory of calculating the power of wind-power machine are presented with tables and diagrams. Data for several large wind-power machines constructed in the U.S.A., Great Britain, etc are given. The conclusion is reached that the use of wind power in Sweden is not feasible, primarily because of its high cost per kWh. Author

N74-19709*# Scientific Translation Service, Santa Barbara, Calif.
HIGH WIND POWER PLANTS
H. Honnef Washington NASA Apr. 1974 19 p refs Transl. into ENGLISH from Elektrotech. Maschinenbau (Berlin), v. 57, no. 41 and 42, 13 Oct. 1939 p 501-506
(Contract NASw-2483)
(NASA-TT-F-15444) Avail: NTIS HC $4.00 CSCL 10A

In comparison to the usual power plants in which the machines are installed in special buildings, the high wind power plant is described as a power source in which the structure as a whole makes up the machine. New large structures are supports for generators with large diameters but with the other dimensions small. The use of the advantageous high wind flow leads to unusually high structures, but these are completely storm safe and stable, as well as economical. Details of the counter-rotating turbine and some experimental results are presented. Author

N74-19710*# Kanner (Leo) Associates, Redwood City, Calif.
REPORT OF THE WIND POWER COMMITTEE OF 1962
E. Volmer Nielsen Washington NASA Apr. 1974 32 p Transl. into ENGLISH of "Uddrag af Vindkraftudvalgets Betenkning af 1962", Danish Assoc. of Elec. Supply Undertakings, report, 1962 26 p
(Contract NASw-2481)
(NASA-TT-F-15442) Avail: NTIS HC $4.75 CSCL 10B

The Danish Wind Power Committee's experiments with propeller windmills are described, specifically the 25-m-high windmill at Gedser. Wind measuring stations were established, and the wind energy available and optimum locations determined. A cost comparison was made of electricity from wind and steam power, and the committee concluded that wind power plants were economically unfeasible to develop at that time. Author

N74-19711# Chicago Univ., Ill.
SOLAR CONCENTRATORS OF A NOVEL DESIGN
Roland Winston Mar. 1974 25 p refs
(EFI-74-21) Avail: NTIS HC $4.25 CSCL 10A

A new principle for collecting and concentrating solar energy, the ideal cylindrical light collector has been invented. The collector is a trough-like reflecting wall light channel of a specific shape which concentrates radiant energy by the maximum amount allowed by phase space conservation. The ideal cylindrical light collector is capable of accepting solar radiation over an average 8-hour day and concentrating it by a factor of approximately 10 without diurnal tracking of the sun. This collector has a large acceptance for diffuse light. In fact, the efficiency for collecting and concentrating isotropic radiation, in comparison with a flat plate collector, is just the reciprocal of the concentration factor. Author

N74-19712# Army Aviation Systems Command, St. Louis, Mo.
MAJOR ITEM SPECIAL STUDY (MISS), CH-47A ALTERNATING GENERATOR Interim Report, Jan. 1964 - Jul. 1973
Jan. 1974 24 p
(AD-773720; USAAVSCOM-TR-73-33) Avail: NTIS CSCL 01/3

The report is designed to illustrate cost savings which would result from specific efforts in the areas of product improvement in quality and design. For the purpose of this study the cost savings produced in the area of product improvement are based on total elimination of a certain failure mode or modes. Appropriate modes are chosen because of their proportion of the total removals or their proportion in combination with other similar modes. These eliminated removals are then assumed to follow the distribution of the remaining removal modes. The actual cost savings are determined from the increase in the mean time to removal based on the new removal distributions. GRA

N74-19713# Ford Motor Co., Dearborn, Mich. Scientific Research Staff.
RESEARCH ON ELECTRODES AND ELECTROLYTE FOR THE FORD SODIUM-SULFUR BATTERY Quarterly Report, 30 Jun. - 30 Sep. 1973
Oct. 1973 66 p refs
(Grant NSF C-805)
(PB-225720/2GA) Avail: NTIS HC $5.50 CSCL 10C

The results obtained on the electrodes and electrolyte of the sodium sulfur battery as well as the preferred composition of the solid electrolyte and the method of fabrication are reported. A description of test procedures is also included. Preliminary attempts at rapid sintering are described. In the area of mechanical characterization of the ceramic, a hoop tester using RTV rubber as the loading medium and diametral tests appear promising. Acoustic emission techniques are being developed as a nondestructive test. Raman spectra for sodium tetrasulfide, and sulfur have been gained. Studies of the kinetics of the sulfur electrode have been made using voltage sweep chronoamperometry. GRA

N74-19714# Tyco Labs., Inc., Waltham, Mass.
DEVELOPMENT AND TESTING OF A CADMIUM TELLURIDE HIGH TEMPERATURE (750 F) INFRARED FIRE DETECTOR Final Report, 28 Feb. 1972 - 19 Sep. 1973
G. Entine, R. Farrell, F. Wilson, and F. Wald Nov. 1973 73 p refs
(Contracts F33615-72-C-1489; F33615-71-C-1084; AF Proj. 3048)
(AD-773324; C-222; AFAPL-TR-73-104) Avail: NTIS CSCL 01/2

CdTe photodetectors capable of operating continuously at 750F were packaged for flight testing as an aircraft engine fire detector. The sensors at temperature could detect a photosignal of 50 microwatts per square centimeter with a signal-to-noise ratio of over 20:1 and an output impedance of 1000 ohms. The units consist of two CdTe sensors separately sealed in hermetic TO-8 headers which are mounted inside a larger hermetically sealed housing made of Inconel. The detectors meet MIL-Spec 810B including temperature cycling up to 750F, well above the capability of all the available semiconductor infrared detectors. Author (GRA)

N74-19715# Westinghouse Electric Corp., Cheswick, Pa. Electro-Mechanical Div.
DESIGN AND DEVELOPMENT OF A SEGMENTED MAGNET HOMOPOLAR TORQUE CONVERTER Semiannual Report, 1 Jun. - 30 Nov. 1973
C. J. Mole and F. G. Arcella Jan. 1974 85 p refs
(Contract DAHC15-72-C-0229; ARPA Order 2174)
(AD-773389; EM-4559; SAR-3) Avail: NTIS CSCL 13/10

The program is for the research and development of a new mechanical power transmission concept: the segmented magnet homopolar torque converter. The purpose of this device is to convert unidirectional torque of constant speed (such as from a steam turbine prime mover) into variable speed output torque in either the forward or reverse directions. The concept offers an efficient, lightweight low volume design with potential application over a wide range of speeds and power ratings in the range from hundreds to tens of thousands of horsepower. This machine concept can be applied to commercial and military advanced concept vehicles for both terrain and marine environments. (Modified author abstract) GRA

N74-19716# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SELF-REGULATION OF WATER REMOVAL IN HYDROGEN-OXYGEN FUEL CELL AND THE WIDTH OF SELF-REGULATING ZONES
Yu. M. Volfkovich, V. E. Sosenkin, and V. S. Bagotskii 7 Jan. 1974 19 p refs Transl. into ENGLISH from Inzh. Fiz. Zh. (Moscow), v. 23, no. 4, Oct. 1972 p 618-626
(AD-773520; FTD-HT-23-399-74) Avail: NTIS CSCL 10/2

The effect of various factors on the width of the self-regulation area with a change in the removal and formation rates of water is examined. Conditions are determined at which a fuel cell with capillary diaphragm should be capable of maximum possible self-regulation as the current changes. GRA

N74-19717# Naval Ship Research and Development Center, Annapolis, Md.
PROCEEDINGS OF WORKSHOP ON NAVY ALTERNATE ENERGY SOURCES RESEARCH AND DEVELOPMENT
J. R. Belt, ed. and H. V. Nutt, ed. Jan. 1974 97 p refs Conf. held at Annapolis, 18-20 Sep. 1973
(AD-773746; NSRDC-4195) Avail: NTIS CSCL 21/4

A workshop was held to examine the Navy's energy requirements and the directions that Navy Research and Development should take to minimize the impact on the Navy of projected national petroleum fuel supply shortages. The current state of research and development on liquid fuels from coal and oil shale, as well as the ability to extract from them fuels that are reasonably similar to currently used petroleum products, make it appropriate for the Navy to concentrate first on these. Demonstrations of compatability of Navy power plants with fuels derived from coal or oil shale, and definition of minimum fuel quality requirements, are needed. For the longer term, efforts to harness environmental energy sources, such as winds, currents, and thermal gradients in the earth and in the oceans, appear to have considerable potential payoff, particularly for nonmobile applications. (Modified author abstract) GRA

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N74-19718*# Baylor Univ., Houston, Tex.
PERIODICITY OF HIGH-ORDER NEURAL FUNCTIONS Final Progress Report
Peter Kellaway, Robert P. Borda, James D. Frost, James R. G. Carrie, and Alfred C. Coats 31 Dec. 1973 33 p refs
(Grant NGR-44-003-054)
(NASA-CR-138005) Avail: NTIS HC $4.75 CSCL 06P

The results of recent studies on higher order, integrative processes in the central nervous system are reported. Attempts were made to determine whether these processes exhibit any ongoing rhythmicity which might manifest itself in alterations of attention and alertness. Experiments were also designed to determine if a periodicity approximating that of the REM could be detected in various parameters of brain electrical activity. Author

N74-19719*# Wisconsin Univ., Madison. Dept. of Medicine.
VENOUS RETURN CURVES OBTAINED FROM GRADED SERIES OF VALSALVA MANEUVERS Final Technical Report
S. Martin Mastenbrook, Jr. Jan. 1974 44 p refs
(Grant NGR-50-002-204)
(NASA-CR-137361; ECE-74-2) Avail: NTIS HC $5.25 CSCL 06C

The effects were studied of a graded series of valsalva-like maneuvers on the venous return, which was measured transcutaneously in the jugular vein of an anesthetized dog, with the animal serving as its own control. At each of five different levels of central venous pressure, the airway pressure which just stopped venous return during each series of maneuvers was determined. It was found that this end-point airway pressure is not a good estimator of the animal's resting central venous pressure prior to the simulated valsalva maneuver. It was further found that the measured change in right atrial pressure during a valsalva maneuver is less than the change in airway pressure during the same maneuver, instead of being equal, as had been expected. Relative venous return curves were constructed from the data obtained during the graded series of valsalva maneuvers. Author

N74-19720*# Missouri Univ., Columbia. Space Sciences Research Center.
APPLICATION OF NITROGEN METABOLISM IN AUTOTROPHIC BACTERIA TO CHEMOSYNTHETIC BIOREGENERATION IN SPACE MISSIONS, SUPPLEMENT
Robert L. Wixom 7 Mar. 1974 18 p refs
(Grant NGR-26-003-023)
(NASA-CR-138030; Rept-5814-2229) Avail: NTIS HC $4.00 CSCL 06M

The chemolithotroph, Hydrogenomonas eutropha, was considered as a life support, bioregenerative system. This project focuses on several metabolic functions that are related to the proposed nitrogen cycle between man and this microbe. Specifically this organism has the capability to utilize as the sole nitrogen source such urine components as urea and fifteen individual amino acids, but not nine other amino acids. The effectiveness of utilization was high for many amino acids. Several specific growth inhibitions were also observed. The enzyme that catalyzes the incorporation of ammonia in the medium into amino acids was identified as a NADP-specific, L-glutamate dehydrogenase. This enzyme has a constitutive nature. This organism can synthesize all of its amino acids from carbon dioxide and ammonia. Therefore with the background literature of multiple pathways of individual amino acid biosyntheses, our evidence to date is consistent with the Hydrogeneomonas group having the same pathway of valine-isoleucine formation as the classical E. coli. Author

N74-19721*# Techtran Corp., Glen Burnie, Md.
ACUTE BLOOD LOSS
V. B. Koziner Washington NASA Mar. 1974 33 p refs Transl. into ENGLISH of the book "Patologicheskaya Fiziologiya Ekstremal' nykh Sostoyaniy" Moscow, Meditsian Press, 1973 p 160-179
(Contract NASw-2485)
(NASA-TT-F-15369) Avail: NTIS HC $4.75 CSCL 06E

The physiology and treatment of various types of blood loss is described. Various stages of blood loss are characterized by severity. The efficacy of blood replacing substances and plasmas is discussed. Experiments on animals to determine the effective blood loss and the tolerance of the organism to blood loss are described. The current state of blood transfusion practices is evaluated. Author

N74-19722*# Linguistic Systems, Inc., Cambridge, Mass.
EXPERIMENTAL RESTRAINT ULCER IN THE WHITE RAT. 1: METHODS, INCIDENCE OF LESIONS, AND MODIFICATIONS BY CERTAIN TECHNICAL AND PHARMACODYNAMIC TECHNIQUES
S. Bonfils, G. Rossi, G. Liefooghe, and A. Lambling Washington NASA Mar. 1974 13 p refs Transl. into ENGLISH from Rev. Franc. Etudes Clin. Biol. (Paris), v. 4, 1959 p 146-150
(Contract NASw-2482)
(NASA-TT-F-15381) Avail: NTIS HC $4.00 CSCL 06C

The experimental method, which is relatively simple and does not involve surgery or pharmodynamic techniques, is described. Female white rats weighing 150 to 190 g were used in the study. Author

N74-19723*# Scientific Translation Service, Santa Barbara, Calif.
THE CONTENT OF ASCORBIC ACID IN THE ADRENAL GLANDS AND THE PRODUCTION OF CORTICOSTEROIDS IN VITRO IN IRRADIATED, IMMOBILIZED, AND HYPOPHYSECTOMIZED RATS
E. R. Bagramyan Washington NASA Mar. 1974 15 p refs Transl. into ENGLISH from Probl. Endokrinol. i Gormonoterap. (Moscow), v. 12, Sep. - Oct. 1966 p 66-72
(Contract NASw-2483)
(NASA-TT-F-15383) Avail: NTIS HC $4.00 CSCL 06C

In rats immobilized for a period of one hour the content and concentration of ascorbic acid in the adrenal glands fell, whereas corticosteroid production intensified. There was a rise of biosynthetic capacity of the adrenal tissue. No change occurred in the weight of the adrenal glands under the effect of immobilization. In hypophysectomized rats, 2 weeks after the operation a marked reduction of the adrenal gland weight and ascorbic acid content in them was noted. Ascorbic acid content rose, and corticosteroid production exhibited a drop in experiments in vitro. At the height of radiation sickness in irradiated rats there was a rise of the adrenal gland weight and an increase of ascorbic acid contents in them. Ascorbic acid content failed to change, and corticosteroid production increased in vitro. These changes did not develop in hypophysectomized animals. Author

N74-19724*# Scientific Translation Service, Santa Barbara, Calif.

RADIATION HAZARD IN SPACE
L. I. Miroshnichenko Washington NASA Apr. 1974 22 p refs Transl. into ENGLISH from Priroda (Moscow), no. 10, Oct. 1973 p 10-16
(Contract NASw-2483)
(NASA-TT-F-15400) Avail: NTIS HC $4.25 CSCL 06R

Radiation hazard in space travel as it has been estimated based on the data of Soviet and American spaceflights and terrestrial experiments is discussed. Calculations, charts and graphs are provided to clarify the text. Many data are drawn from the Apollo projects. Author

N74-19725*# Scientific Translation Service, Santa Barbara, Calif.
MORPHOMETRIC, PHYSIOLOGICAL, HISTOLOGICAL, AND BIOCHEMICAL CHANGES IN RAT FOOT EXTENSORS IMMOBOLIZED BY PLASTER
C.-P. Simard Washington NASA Mar. 1974 35 p refs Transl. into ENGLISH from La Vie Medicale au Can. Franc. (Canada), v. 2, Apr. 1973 p 325-340
(Contract NASw-2483)
(NASA-TT-F-15423) Avail: NTIS HC $4.75 CSCL 06S

The development of muscular and osseous atrophy of the immobilized foot of a rat is studied. The morphometric, physiological, and biochemical parameters of the extensors, immobolized in plaster, are investigated. The statistical analysis of the results shows significant differences with respect to the three parameters studied. Author

N74-19726*# Hardin-Simmons Univ., Abilene, Tex. Dept. of Biology.
A STUDY OF PSYCHROPHILIC ORGANISMS ISOLATED FROM THE MANUFACTURE AND ASSEMBLY AREAS OF SPACECRAFT TO BE USED IN THE VIKING MISSION Planetary Quarantine Activities Report, 1 Jul. - 31 Dec. 1973
Terry L. Foster and Luther Winans, Jr. Feb. 1974 41 p Presented at the Semiannual NASA Spacecraft Sterilization Technol. Seminar, San Francisco, 20-21 Feb. 1974
(Grant NGR-44-095-001)
(NASA-CR-137346; Rept-3) Avail: NTIS HC $5.25 CSCL 06M

The ability of psychrophilic microorganisms to grow in some of the environmental conditions suggested for Mars is studied with particular attention given to the effects of moisture and nutrients on growth. Results of growth with the slide culture technique are presented and indicate that this technique can be a rapid and sensitive technique for demonstration of microbial growth under various environmental conditions. Additional soil samples have been obtained from Cape Kennedy, and results of these assays at various low temperatures for psychrophilic populations are presented. The heat resistance of some of the psychrophilic sporeformers have been determined. Psychrophilic organisms were isolated from the teflon ribbons at Cape Kennedy and characterization of these was begun. In addition, heat survivors from the teflon ribbons are being investigated, and partial characterizations of these are presented. Author

N74-19727*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PLANETARY QUARANTINE: SPACE RESEARCH AND TECHNOLOGY Semiannual Review, 1 Jul. - 31 Dec. 1973
Apr. 1974 132 p refs
(Contract NAS7-100)
(NASA-CR-137345; JPL-900-655) Avail: NTIS HC $9.75 CSCL 06M

The impact of satisfying satellite quarantine constraints on current outer planet mission and spacecraft designs is considered. Tools required to perform trajectory and navigation analyses for determining satellite impact probabilities are developed. Author

N74-19728*# Techtran Corp., Glen Burnie, Md.
CLINICAL AND EXPERIMENTAL INVESTIGATIONS WITH SERNYL AND COMBELEN FOR IMMOBILIZATION OF RUMINANTS
S. Jancke and A. Kuntze Washington NASA Mar. 1974 10 p refs Transl. into ENGLISH from Arch. Exp. Veterinaermed. (Leipzig), v. 25, 1971 p 847-852
(Contract NASw-2485)
(NASA-TT-F-15422) Avail: NTIS HC $4.00 CSCL 06E

By using a combination of Sernyl (phencyclidine) and Combelen (propionylpromazine), 86 ruminants belonging to 23 species and subspecies were immobilized. Sixty-two of the animals were in Berlin Zoo and the remainder in various game reserves. The onset of immobilization after injection of 0.5-4.0 Sernyl and 0.01-0.13 ml Combelen solution per kg body weight varied in different species from 5 to 100 minutes (average 7-12) after injection and it lasted for 10-240 minutes. Fallow deer required a much higher dosage than the other Cervidae. As a rule, high dosage produced longer and deeper anesthesia. Experiments on five domestic sheep and four goats showed that 5 or 6 times the normal dosage was well tolerated. A toxic effect was not seen until ten times the normal dosage (10 mg Sernyl + 0.1 ml Combelen solution) was given - 3 of 7 animals died. Two of those that died developed hyperthermia (41 C). Author

N74-19729*# California Univ., Los Angeles. Dept. of Biology.
AN ANALYSIS OF THE CIRCUITRY OF THE VISUAL PATHWAY OF THE LATERAL EYE OF LIMULLUS Final Progress Report, 1 Apr. 1969 - 31 Mar. 1970
Fritiof S. Sjoestrand 31 Mar. 1970 12 p
(Grant NGR-05-007-205)
(NASA-CR-132941) Avail: NTIS HC $4.00 CSCL 06P

The methodology is discussed for three-dimensional analysis of the nervous system on the basis of electron micrographs of serial sections. An analysis is presented of a part of the circuitry of the rabbit retina. In addition, some exploratory work is reported with respect to the visual cortex of the cat brain. A proper technique for preservation of the visual cortex was worked out and a technique to localize microelectrode tips in the tissue in connection with electron microscopy was partially worked out. Author

N74-19730# Joint Publications Research Service, Arlington, Va.
SPACE BIOLOGY AND AEROSPACE MEDICINE, VOLUME 8, NO. 1, 1974
15 Apr. 1974 141 p refs Transl. into ENGLISH of Kosmich. Biol. Aviakosmich. Med. (Moscow), v. 8, no. 1, Jan.-Feb. 1974 (JPRS-61487) Avail: NTIS HC $10.25

The problems of acceleration tolerance, weightlessness simulation, circadian rhythm disturbances, and hypokinesia in manned space flight are considered. For individual titles, see N74-19731 through N74-19751.

N74-19731 Joint Publications Research Service, Arlington, Va.
EFFECT OF TRANSMERIDIONAL FLIGHTS ON THE HUMAN BODY
S. I. Stepanova *In its* Space Biol. and Aerospace Med., Vol. 8, No. 1, 1974 (JPRS-61487) 15 Apr. 1974 p 1-14 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), v. 8, no. 1, Jan.-Feb. 1974 p 3-12 (For availability see N74-19730 11-04)

The pertinent literature is reviewed. The functions which have exhibited desynchronosis after transmeridional flights are described. The relationship between the time of synchronization of circadian rhythms in the body and local time and the level of the time change, individual factors, geographical direction of the flight (to the west or east) and the outgoing and return flight is discussed. Recommendations on how to reduce the negative effect of transmeridional flights on flight personnel, athletes and businessmen are presented. Author

N74-19732 Joint Publications Research Service, Arlington, Va.
PROBLEMS IN SPACE RADIOBIOLOGY AND RADIATION SAFETY OF SPACE FLIGHTS
C. A. Tobias and Yu. G. Grigoryev *In its* Space Biol. and Aerospace Med., Vol. 8, No. 1, 1974 (JPRS-61487) 15 Apr. 1974 p 15-26 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), v. 8, no. 1, Jan-Feb. 1974 p 12-21 (For availability see N74-19730 11-04)

Main criteria for evaluating radiation hazards of different space flights and qualitative characteristics of these criteria are presented. The results of radiobiological investigations in space are given and approaches to determination of the admissible

levels of exposure cosmonauts to irradiation are described. The objectives of advanced research are considered. Author

N74-19733 Joint Publications Research Service, Arlington, Va.
STATISTICAL DYNAMICS OF OXYGEN CONSUMPTION BY MAN DURING MODERATE PHYSICAL WORK
V. K. Vasilyev *In its* Space Biol. and Aerospace Med., Vol. 8, No. 1974 (JPRS-61487) 15 Apr. 1974 p 27-34 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), v. 8, no. 1, Jan.-Feb. 1974 p 27-34 (For availability see N74-19730 11-04)

Transient processes of oxygen consumption by man performing moderate physical exercises (about 600 kgm/min) are described mathematically by second degree differential equations, the right hand of which are a function of the load. Mathematical expectations and correlation functions for impulse transient functions are given. Formulas are derived for the first two statistical moments for perturbation to the oxygen partial pressure control circuit in a sealed chamber. The data obtained are used in analyzing and selecting the performance of the oxygen partial pressure control circuit in a life support system. Author

N74-19734 Joint Publications Research Service, Arlington, Va.
USE OF BIOMECHANICS IN INVESTIGATION OF THE HUMAN CARDIOVASCULAR SYSTEM DURING PROLONGED SPACEFLIGHT
V. M. Zaiko and V. G. Aleksandrov *In its* Space Biol. and Aerospace Med., Vol. 8, No. 1, 1974 (JPRS-61487) 15 Apr. 1974 p 35-40 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), v. 8, no. 1, Jan.-Feb. 1974 p 27-31 (For availability see N74-19730 11-04)

Biomechanical methods can be used in studying the cardiovascular function of cosmonauts exposed to prolonged spaceflight. An adequate mathematical model of a pulsating blood flow in the arteries has been formulated, using the biophysical mechanism of myogenic autoregulation associated evolutionarily with gravity, to calculate cardiovascular parameters on the basis of hemodynamic characteristics measured indirectly in spaceflight. The model also makes it possible to select physiologically sound criteria for determining the duration of a prolonged spaceflight. Author

N74-19735 Joint Publications Research Service, Arlington, Va.
EFFECT OF ELECTRIC STIMULATION OF THE MEDULLA OBLONGATA ON THE ELECTROCARDIOGRAM AND SOME INDICES OF BLOOD CIRCULATION AND RESPIRATION
B. B. Yegorov and S. A. Skuratova *In its* Space Biol. and Aerospace Med., Vol. 8, No. 1, 1974 (JPRS-61487) 15 Apr. 1974 p 41-48 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), v. 8, no. 1, Jan.-Feb. 1974 p 31-36 (For availability see N74-19730 11-04)

Chronic and acute experiments were carried out on rabbits. The effect of electric stimulation of the medulla oblongata on arterial pressure, the EKG, respiration and the EEG of the cortex and subcortical structure of the brain was investigated. In most cases stimulation of the medulla oblongata was accompanied by an increase in partial pressure, a decrease in the pulse rate and an increase in respiration rate. It also induced synchronization in the cortex and regulation of the rhythm in subcortical formations. No significant correlation was found between EEG changes and autonomic parameters. Author

N74-19736 Joint Publications Research Service, Arlington, Va.
EFFECT OF ADEQUATE STIMULATION OF THE VESTIBULAR APPARATUS ON IMPULSE ACTIVITY OF SPINAL INTERNEURONS
G. S. Ayzikov and A. V. Mokrousova *In its* Space Biol. and Aerospace Med., Vol. 8, No. 1, 1974 (JPRS-61487) 15 Apr. 1974 p 49-56 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), v. 8, no. 1, Jan.-Feb. 1974 p 36-41 (For availability see N74-19730 11-04)

The spontaneous impulse activity of plates 7-9 of the lumbosacral part of the spinal cord during adequate stimulation of the otoliths was studied. The following four types of response were discriminated: increase and decrease in impulse activity, appearance of salvo activity at definite moments in movement of the stand with the animals and the absence of changes in rhythm of the neurons. It was noted that the period of stimulation of the otoliths was accompanied by phasic changes in the rhythm of interneurons which disappeared with cessation of swinging. The noted changes - quickening or thinning of impulse activity - can persist for a long time during the period of the aftereffect of vestibular stimulation. Author

N74-19737 Joint Publications Research Service, Arlington, Va.
EXTRASECRETORY FUNCTION OF THE LIVER AND ENZYME SECRETORY FUNCTION OF THE PANCREAS IN RATS AFTER EXPOSURE TO ACCELERATIONS
K. V. Smirnov, I. L. Medkova, and L. G. Goland *In its* Space Biol. and Aerospace Med., Vol. 8, No. 1, 1974 (JPRS-61487) 15 Apr. 1974 p 57-62 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), v. 8, no. 1, Jan.-Feb. 1974 p 41-45 (For availability see N74-19730 11-04)

The extrasecretory function of the liver and the enzyme secretory function of the pancreas in rats were studied during the immediate aftereffect period of exposure to transverse accelerations of 10 g for 20 minutes. The biochemical analysis of the main components of bile and the activity of pancreatic enzymes in the pancreas and blood exhibited an increase in the lipid concentration, activation of lipolytic enzymes and inhibition of the activity of amylase and trypsin. These changes were exhibited three hours after the exposure. At later periods (up to six days) the mentioned parameters exhibited a phasic pattern. The changes in the secretory functions of the liver and pancreas seem to be associated with hemodynamic disturbances. Author

N74-19738 Joint Publications Research Service, Arlington, Va.
EFFECT OF ACCELERATIONS ON THE ACTIVITY OF ASPARTATE AMINOTRANSFERASE OF THE EXTERNAL AND INTERNAL MEMBRANES OF MITOCHONDRIA
I. D. Yertanov and L. A. Rubashkina *In its* Space Biol. and Aerospace Med., Vol. 8, No. 1, 1974 (JPRS-61487) 15 Apr. 1974 p 63-66 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), v. 8, no. 1, Jan.-Feb. 1974 p 45-47 (For availability see N74-19730 11-04)

Exposure of rats to transverse accelerations of 36 g for six minutes decreased the specific activity of aspartate aminotransferase of the outer and inner membranes of mitochondria. It is concluded that the decrease was not associated with the intramitochondrial movement of enzyme molecules. This may be brought about by an inactivation of the enzyme by the specific inhibitor or by conformational changes in the structure which followed the formation of the enzyme membrane complex. Author

N74-19739 Joint Publications Research Service, Arlington, Va.
SYNTHESIS OF METHYL ALCOHOL FROM CARBON DIOXIDE AND HYDROGEN FOR REPRODUCING ARTIFICIAL SUGARS c06
M. G. Rozenfeld, M. T. Rusov, S. K. Sachenko, and Yu. Ye. Sinyak *In its* Space Biol. and Aerospace Med., Vol. 8, No. 1, 1974 (JPRS-61487) 15 Apr. 1974 p 67-74 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), v. 8, no. 1, Jan.-Feb. 1974 p 47-53 (For availability see N74-19730 11-04)

On the basis of thermodynamic values of components in a reaction mixture, the equation constants were calculated for the synthesis of methyl alcohol from carbon dioxide and hydrogen at normal atmospheric pressure and temperatures of 150-400 C. Calculation of equilibrium concentrations in a stoichiometric mixture demonstrated that the absolute quantities of methyl alcohol formed under these conditions were small. In addition, the possibility of side reactions made this process scarcely feasible. The equilibrium constant, transformation level and equilibrium content of methyl alcohol in a stoichiometric mixture at a pressure of 25-350 atm and temperatures of 150-400 C were also determined. It is shown that a high content of methyl alcohol can be attained at such low pressures as 50-100 atm. Author

N74-19740 Joint Publications Research Service, Arlington, Va.
PSYCHOPHYSIOLOGICAL CHANGES IN AN AIRMAN'S ACTIVITY UNDER THE INFLUENCE OF ALCOHOL
B. M. Pikovskiy *In its* Space Biol. and Aerospace Med., Vol. 8, No. 1, 1974 (JPRS-61487) 15 Apr. 1974 p 75-79 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), v. 8, no. 1, Jan-Feb. 1974 p 53-56 (For availability

see N74-19730 11-04)

Alcohol induced changes in the human body exert a negative effect on man's activity and therefore should be regarded as generalized noise in functioning of the man machine system. Disturbances in human activity may occur both in the perception and evaluation of information and in the motor responses. Insignificant doses of alcohol taken before flight or its after-effect contribute to in-flight emergency situations. Safety measures should include up-to-date methods for the diagnosis of alcohol intoxication and widespread propaganda indicating that the day before the flight and on the day of the flight aircraft personnel must not drink. Author

N74-19741 Joint Publications Research Service, Arlington, Va.
USE OF DIFFERENT METHODS FOR STUDYING SMALL GROUPS APPLICABLE TO GROUP SCREENING PROBLEMS c05
N. A. Gosudarev *In its* Space Biol. and Aerospace Med., Vol. 8, No. 1, 1974 (JPRS-61487) 15 Apr. 1974 p 80-87 refs Transl. into ENGLISH from Kosmich. biol. Aviakosmich. Med. (Moscow), v. 8, no. 1, Jan.-Feb. 1974 p 80-87 (For availability see N74-19730 11-04)

The possibility of prolonged group space flights makes the optimum selection of space crews very important. A series of methods for evaluating the psychological compatibility of crew members has been developed on the basis of theoretical and methodological findings in a group selection system. These methods were used in studying the personality relationships among members of isolated groups which were exposed to conditions similar to spaceflight as well as personality responses as a function of the position occupied by an individual in the group. The use of the methods is illustrated by examinations of skiers who traversed an arctic region in Long Strait. Author

N74-19742 Joint Publications Research Service, Arlington, Va.
FUNCTIONAL TEST WITH DECOMPRESSION OF THE LOWER BODY IN THIRTY-DAY ANTIORTHOSTATIC HYPOKINESIA
V. A. Degtyarev, A. D. Voskresenskiy, N. D. Kalmykova, and Z. A. Kirillova *In its* Space Biol. and Aerospace Med., Vol. 8, No. 1, 1974 (JPRS-61487) 15 Apr. 1974 p 88-92 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), v. 8, no. 1, Jan-Feb. 1974 p 61-65 (For availability see N74-19730 11-04)

Nine test subjects underwent functional tests with LBNP applied at -35 and -45 mm Hg for ten minutes during a 30-day hypokinetic experiment. Subjectively they tolerated the tests well. Cardiovascular responses were similar to orthostatic responses but less pronounced. During hypokinesia the response to the tests increased. A statistical analysis of the relationship between the heart rate and integral evaluations revealed a correlation between responses to LBNP of -45 mm Hg and the orthostatic load ($r = 0.71$). This indicates the possibility of predicting orthostatic reactions on the basis of LBNP tests. Author

N74-19743 Joint Publications Research Service, Arlington, Va.
INFLUENCE OF THIRTY-DAY HYPOKINESIA IN COMBINATION WITH EXPOSURE TO LBNP ON TOLERANCE TO ACCELERATIONS (PLUS Gz)
P. M. Suvorov *In its* Space Biol. and Aerospace Med., Vol. 8, No. 1, 1974 (JPRS-61487) 15 Apr. 1974 p 93-97 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), v. 8, no. 1, Jan.-Feb. 1974 p 65-68 (For availability see N74-19730 11-04)

The effect of hypokinesia combined with LBNP on human tolerance to accelerations are studied. Before and after hypokinesia the subjects were centrifuged at 3 g for 30 sec and at 5 g as long as it could be tolerated. Two days after exposure to hypokinesia and LBNP the duration of tolerance to accelerations of 5 g was 24.2-36.5% of the initial level. This may be brought about by the functional activity of the muscular system and venous tone which results in a marked decrease in systolic volume and cardiac output during exposure to accelerations and accordingly in the early development of optic disturbances. Author

N74-19744 Joint Publications Research Service, Arlington, Va.
ROENTGENOLOGICAL STUDY OF CARDIAC FUNCTION AND MINERAL SATURATION OF BONE TISSUE AFTER THIRTY-DAY HYPOKINESIA
I. G. Krasnykh *In its* Space Biol. and Aerospace Med., Vol. 8, No. 1, 1974 (JPRS-61487) 15 Apr. 1974 p 98-103 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), v. 8, no. 1, Jan.-Feb. 1974 p 68-71 (For availability see N74-19730 11-04)

Before and on the fourth day of a 30-day bed rest experiment the cardiac size and output, as well as the contractile function of the myocardium were measured using teleroentgenokymograms. Bone density of the right heel bone and the first phalanx of the fifth finger on the right hand was determined roentgenophotometrically. In the early recovery period the cardiac size, cardiac output and the force of cardiac contractions decreased whereas the heart rate increased. Bone density also decreased. The countermeasures applied - physical exercises, lower body negative pressure and muscle electrostimulation - reduced the mentioned changes but did not eliminate them entirely. Author

N74-19745 Joint Publications Research Service, Arlington, Va.
EFFECT OF 30-DAY HYPOKINESIA IN COMBINATION WITH LBNP TRAINING ON SOME INDICES OF THE FUNCTIONAL STATE OF THE CARDIOVASCULAR SYSTEM AT REST
A. N. Aleksandrov and A. K. Kochetov *In its* Space Biol. and Aerospace Med., Vol. 8, No. 1, 1974 (JPRS-61487) 15 Apr. 1974 p 104-105 Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), v. 8, no. 1, Jan.-Feb. 1974 p 71-72 (For availability see N74-19730 11-04)

The effect of 30-day bed rest and LBNP training on the functional state of the cardiovascular system at rest was studied in two groups of test subjects. A moderate decline in tone and a delay in blood rate flow were noted in the leg vessels (mainly venules). The systolic blood volume decreased. The cardiac output at first decreased and then gradually increased, reaching the initial level by the 30th day, due to an increase in the heart rate. The changes in the EKG T wave suggested metabolic changes in the myocardium. These changes in the EKG were more distinct in test subjects who were daily subjected to LBNP training. Author

N74-19746 Joint Publications Research Service, Arlington, Va.
REACTIONS OF THE CARDIOVASCULAR SYSTEM DURING 30-DAY SIMULATION OF WEIGHTLESSNESS BY MEANS OF ANTIORTHOSTATIC HYPOKINESIA
A. V. Beregovkin and V. V. Kalinichenko *In its* Space Biol. and Aerospace Med., Vol. 8, No. 1, 1974 (JPRS-61487) 15 Apr. 1974 p 106-112 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), v. 8, no. 1, Jan.-Feb. 1974 p 72-77 (For availability see N74-19730 11-04)

Cardiovascular reactions of nine test subjects were investigated during 30-day bed rest with their heads tilted down 4 deg from the horizontal. Before and after the bed rest experiment the test subjects performed five minute vertical standing tests. During bed rest tests the subjects exhibited moderate changes in the functional state of the cardiovascular system. The use of preventive measures - physical exercises, lower body negative pressure and muscle electrostimulation - had a favorable effect on cardiovascular conditioning. This was suggested by a faster recovery of the functional state of the cardiovascular system after completion of the experiment. Author

N74-19747 Joint Publications Research Service, Arlington, Va.
DYNAMICS OF SOME INDICES OF THE CARDIAC FUNCTION AND ITS CORRELATIONS WITH SYSTEMIC CIRCULATION DURING THE DAY IN MAN
I. Ye. Oranskiy, V. V. Skryabin, V. S. Sakovich, and A. Ye. Myakota *In its* Space Biol. and Aerospace Med., Vol. 8, No. 1, 1974 (JPRS-61487) 15 Apr. 1974 p 113-118 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), v. 8, no. 1, Jan.-Feb. 1974 p 77-80 (For availability see N74-19730 11-04)

Examinations of 60 persons revealed a certain circadian periodicity of their cardiac function which was dependent in general on their mental and physical activity. The correlations of conjugated parameters of cardiodynamics and hemodynamics were varied and associated with many factors that often were not taken into account. Author

N74-19748 Joint Publications Research Service, Arlington, Va.
FISTULA TUBE AND REGIME OF FORCED FEEDING OF EXPERIMENTAL ANIMALS
N. T. Svistunov *In its* Space Biol. and Aerospace Med., Vol. 8, No. 1, 1974 (JPRS-61487) 15 Apr. 1974 p 119-124 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), v. 8, no. 1, Jan.-Feb. 1974 p 80-84 (For availability see N74-19730 11-04)

The design of a stomach fistula tube is reported that contains flexible flange in its sleeve to be applied by sutures to the inner side of the abdominal well. The method for its implantation is presented and a regime for feeding the experimental animals is selected. G.G.

N74-19749 Joint Publications Research Service, Arlington, Va.
MAN'S TOLERANCE TO CHEST-BACK TRANSVERSE ACCELERATIONS
Ye. B. Shulzhenko, I. F. Vil-Vilyams, T. N. Krupina, V. I. Pervushin, and M. P. Aleksandrova *In its* Space Biol. and Aerospace Med., Vol. 8, No. 1, 1974 (JPRS-61487) 15 Apr. 1974 p 125-127 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), v. 8, no. 1, Jan.-Feb. 1974 p 84-85 (For availability see N74-19730 11-04)

Physiological reactions, characterizing man's tolerance of transverse accelerations, are studied by observing cardiovascular and muscle reactions to centrifuging stress. Results of the experiments reveal that the duration of exposure varies broadly; phase shifts in bioelectric activity of the myocardium and muscles are observed criteria. Functional changes in the central nervous system of some subjects persist for five to six days and have the characteristics of circulatory impairment. G.G.

N74-19750 Joint Publications Research Service, Arlington, Va.
MODULATING INFLUENCE OF THE OTOLITHS ON REFLEXES OF THE SEMICIRCULAR CANALS
A. A. Lakoza and A. A. Shipov *In its* Space Biol. and Aerospace Med., Vol. 8, No. 1, 1974 (JPRS-61487) 15 Apr. 1974 p 128-131 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), v. 8, no. 1, Jan.-Feb. 1974 p 85-87 (For availability see N74-19730 11-04)

The influence of otolithic formations on the reflexes from the semicircular canals was studied using models of a unilateral labyrinthectomy. Change in the frequency of fallout nystagmus in the case of tilts of the animal in different directions was observed. Author

N74-19751 Joint Publications Research Service, Arlington, Va.
THRESHOLD VALUES OF CORIOLIS ACCELERATION DURING MAN'S ROTATION WITH HEAD MOVEMENTS IN THE SAGITTAL AND FRONTAL PLANES
F. A. Solodovnik *In its* Space Biol. and Aerospace Med., Vol. 8, No. 1, 1974 (JPRS-61487) 15 Apr. 1974 p 132-135 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), v. 8, no. 1, Jan.-Feb. 1974 p 87-89 (For availability see N74-19730 11-04)

The threshold values were determined for Coriolis accelerations acting on the vestibular apparatus during man's rotation with movement of the head in the sagittal and frontal planes. Author

N74-19752*# Techtran Corp., Glen Burnie, Md.
INFLUENCE OF PROLONGED HYPODYNAMIA ON CERTAIN PHYSIOLOGICAL FUNCTIONS IN DOGS
B. R. Yaremenko Washington NASA Apr. 1974 8 p refs Transl. into ENGLISH from Patol. Fiziol. i Eksperim. Terapiya (Moscow), v. 14, 1970 p 10-13
(Contract NASw-2485)
(NASA-TT-F-15420) Avail: NTIS HC $4.00 CSCL 06S

In experiments on 20 dogs, lasting 14-28 days, the general behavior of the animals and the modification of a number of parameters were studied with restriction of the motor activity of the animals in special stands. The animals were divided into two groups on the basis of their reactions to hypodynamia: those with active behavior, and those with progressive general inhibition and early development of muscular weakness. During the first two weeks, all of the animals showed a gradual increase in arterial pressure, which remained elevated subsequently; the level of the pressor sinocarotid reflects decreased, and the body weight fell. Pulse rate and body temperature did not change appreciably. Author

N74-19753# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario). Biosciences Div.
THE ROLE OF DIETARY FAT IN ENHANCING COLD TOLERANCE: A REVIEW OF THE LITERATURE
M. J. Baigent Jul. 1973 11 p refs
(DCIEM-73-R-951) Avail: NTIS HC $4.00

The evidence in favor of an enhanced cold tolerance due to increased dietary fat during chronic exposure to cold is not convincing for either experimental animals or for human subjects. Cold tolerance during exposure to more acute condition does seem to improve as a consequence of higher fat levels. This improvement, however, appears to be facilitated by, if not dependent upon, such ancillary factors as a period of pre-adaptation to the experimental diet prior to cold exposure, or frequent feedings during exposure. The value of preconditioning an animal or individual to specific timing or frequency of meals prior to cold exposure has not been explored to any degree but appears to merit serious consideration. Author

N74-19754*# Minnesota Univ., Minneapolis. Div. of Environmental Health.
ENVIRONMENTAL MICROBIOLOGY AS RELATED TO PLANETARY QUARANTINE Semiannual Progress Report
Irving J. Pflug Dec. 1972 108 p refs
(Grant NGL-24-005-160)
(NASA-CR-138002; SAPR-9) Avail: NTIS HC $8.50 CSCL 06M

The experimental design of a study to evaluate the effect of different cleaning methods and storage conditions on the dry heat resistance of Bacillus subtilis var. niger spores is described and the results for the first evaluation are reported. Specifically, the synergistic effect which occurs when spores are subjected simultaneously to dry heat and gamma radiation so as to be able to specify thermoradiation sterilization cycles was investigated. Attempts were made to understand the underlying mechanism(s) that lead to spore death from this combination of stresses. Data cover: (1) the survival of spores on surfaces at various temperatures in a precisely controlled environmental system, (2) the rate of destruction of these spores at ambient temperature when subjected to gamma radiation, and (3) the rate of destruction of spores when they are subjected to combined gamma radiation and thermal stresses. Author

N74-19755*# Exotech Systems, Inc., Falls Church, Va.
SCIENTIFIC AND TECHNICAL SERVICES DIRECTED TOWARD THE DEVELOPMENT OF PLANETARY QUARANTINE MEASURES FOR AUTOMATED SPACECRAFT Final Report
31 Mar. 1974 76 p
(Contract NASw-2503)
(NASA-CR-138001) Avail: NTIS HC $7.00 CSCL 06M

The work is reported, which was performed in the specific tasks of the Planetary Quarantine research program for developing parameter specifications of unmanned scientific missions to the planets. The effort was directed principally toward the advancement of the quarantine technology, applicable to all future missions to planets of biological interest. The emphasis of the research was on coordinated evaluation, analysis, documentation, and presentation of PQ requirements for flight projects such as Viking and Pioneer. F.O.S.

N74-19756# Florida Univ., Gainesville. Dept. of Entomology and Nematology.
DETERMINATION OF OPTIMUM SYSTEM AND AIRCRAFT FOR AERIAL DISPERSAL OF INSECTICIDES FOR CONTROL OF INSECTS OF MEDICAL IMPORTANCE Final Report, 1 Aug. 1972 - 31 Jul. 1973
Claude T. Adams, Sr. and William G. Eden 31 Jul. 1973 60 p refs
(Contract DADA17-72-C-2180)
(AD-772002) Avail: NTIS CSCL 06/6

Investigations reported are the results of an extensive survey to determine the most desirable systems characteristics for use in the aerial application of insecticides. A study of the droplet size formation is presented, and appears to be the most critical

single factor from an economic and operational standpoint. The impact of varied micrometeorological phenomena is discussed. Formation of the droplet and the development of the droplet spectrum however present the greatest problems. Information on droplet formation through the use of rotary nozzles is reviewed and compared to droplet production by the hydraulic nozzle. A critical review of currently available equipment, both in-service and by contract is presented and the salient features of each are discussed. A review of in-service aircraft, potentially useful in this operation, is presented. Critical features of each type of aircraft are discussed, and the field of choice is narrowed to a single aircraft. A review of currently available insecticides for aerial dispersal is presented with unit cost/acre data. (Modified author abstract) GRA

N74-19757# Naval Medical Research Inst., Bethesda, Md.
BIBLIOGRAPHY OF REPORTED BIOLOGICAL PHENOMENA ('EFFECTS') AND CLINICAL MANIFESTATIONS ATTRIBUTED TO MICROWAVE AND RADIO-FREQUENCY RADIATION, SUPPLEMENT NO. 4 Medical Research Interim Report
Zorach R. Glaser Jun. 1973 24 p refs
(MF12524015)
(AD-770621) Avail: NTIS CSCL 06/18

More than 325 additional references on the biological responses to radio frequency and microwave radiation, published up to May 1973, are included in this bibliography of the world literature. Particular attention has been paid to the effects of non-ionizing radiation on man at these frequencies. The citations are arranged alphabetically by author, and contain as much information as possible so as to assure effective retrieval of the original documents. Soviet and East European literature is included in detail. (Modified author abstract) GRA

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N74-19758+ Advisory Group for Aerospace Research and Development, Paris (France).
BIBLIOGRAPHY OF PAPERS AND REPORTS RELATED TO THE GUST UPSET/PILOT DISORIENTATION PROBLEMS
Clifford F. Newbarry, comp. (Boeing Co., Wichita, Kans.) Feb. 1974 20 p refs
(AGARD-R-616) Avail: NTIS HC $4.00

A compilation of papers and reports relating to the problem of an airplane being upset for atmospheric disturbances and the pilot being disorientated as a result of the upset is presented. Papers are listed by title and report number and, a summary is also provided where available. Author

N74-19759 Michigan Univ., Ann Arbor.
THE MANUAL CONTROL OF VEHICLES UNDERGOING SLOW TRANSITIONS IN DYNAMIC CHARACTERISTICS Ph.D. Thesis
Thomas Edward Moriarty 1973 141 p
Avail: Univ. Microfilms Order No. 74-3700

The manual control of a vehicle with slowly time-varying dynamics is discussed along with the development of analytic techniques and computer implementation necessary for the study of time-varying systems. This research deals with the human operator as he controls a time-varying plant in which the changes are neither abrupt nor so slow that the time variations are unimportant. An experiment in which human pilots controlled the longitudinal model of a simulated time-varying aircraft is described. The vehicle changed from a pure double integrator to a damped second order system, either instantaneously or smoothly over time intervals of 30, 75, or 120 seconds. It is shown that the pilot's performance in the time-varying task is essentially equivalent to his performance in stationary tasks which correspond to various points in the transition. Dissert. Abstr.

N74-19760*# Scientific Translation Service, Santa Barbara, Calif.
CROSS-ACCLIMATIZATION BETWEEN BODY TRAINING AND ALTITUDE TOLERANCE
E. D. Voight Washington NASA Apr. 1974 10 p refs Transl. into ENGLISH from Beitr. Weltraumbiol. Biophys., DVLR report DLR-FB-68-24 (Bad Godesberg), Apr. 1968 p 49-56 Presented at Meeting of Extraterrestrial Biophys. and Biol., Frankfurt au Main, 26-27 Oct. 1966
(Contract NASw-2483)
(NASA-TT-F-15434; DLR-FB-69-24) Avail: NTIS HC $4.00 CSCL 05E

Cross acclimatization between physical training and oxygen deficiency is indicated by measurements of adrenal corticosteroid levels in rowers in and out of training. Cross acclimatization is also indicated in nonathletes before, during, and after exposure in an altitude chamber at a pressure equivalent to 6,900 m. Blood ATP measurements agree. Author

N74-19761*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
VISUAL EXAMINATION APPARATUS Patent Application
Richard F. Haines, James W. Fitzgerald, and Salvadore A. Rositano, inventors (to NASA) Filed 19 Mar. 1974 21 p
(NASA-Case-ARC-10329-2; US-Patent-Appl-SN-452768) Avail: NTIS HC $4.25 CSCL 06B

Visual examination apparatus and, more particularly, an automated visual sensitivity tester for examining the eyes of a human being to determine visual field sensitivity and blind spot size, shape, and position is described. A projection system is provided for projecting dynamic visual stimuli onto a viewing screen which is viewed by a patient through an infinity collimating lens. The projection system also includes several photocells for developing electrical signals commensurate with the projected visual stimuli. Response signals provided by a hand held switch and the electrical signals from photocells are fed into a signal conditioner and then into a control unit which drives an X-Y recorder to provide a record of both stimulus and response signals. NASA

N74-19762*# Scientific Translation Service, Santa Barbara, Calif.
CATALYSIS AND LIFE-SUPPORT SYSTEMS IN OUTER SPACE
O. V. Krylov, V. A. Naumov, and Yu. Ye. Sinyak Washington NASA Apr. 1974 23 p refs Transl. into ENGLISH from Priroda (Moscow), no. 10, Oct. 1973 p 2-9
(Contract NASw-2483)
(NASA-TT-F-15399) Avail: NTIS HC $4.25 CSCL 06K

Several methods of using catalysts in spacecraft life support systems are discussed. Special emphasis is placed on methods (catalytic) of utilizing waste products for crew life support functions. Formulas and charts are provided which show the rough dimensions and operating principles of such catalytically functioning systems. Author

N74-19763*# Life Systems, Inc., Cleveland, Ohio.
DEVELOPMENT OF AN IODINE GENERATOR FOR RECLAIMED WATER PURIFICATION IN MANNED SPACECRAFT APPLICATIONS Final Report, 26 Jun. 1972 - 28 Aug. 1973
R. A. Wynveen, J. D. Powell, and F. H. Schubert Aug. 1973 122 p refs
(Contract NAS1-11765)
(NASA-CR-134219; ER-171-3-2) Avail: NTIS HC $9.25 CSCL 06I

A successful 30-day test is described of a prototype Iodine Generating and Dispensing System (IGDS). The IGDS was sized to iodinate the drinking water nominally consumed by six men, 4.5 to 13.6 kg (10 to 30 lb) water per man-day with a + or - 10 to 20% variation with iodine (I2) levels of 0.5 to 20 parts per million (ppm). The I2 treats reclaimed water to prevent or eliminate microorganism contamination. Treatment is maintained with a residual of I2 within the manned spacecraft water supply. A simplified version of the chlorogen water disinfection concept, developed by life systems for on-site generation of chlorine (Cl2), was used as a basis for IGDS development. Potable water contaminated with abundant E. Coliform Group organisms

was treated by electrolytically generated I2 at levels of 5 to 10 ppm. In all instances, the E. coli were eliminated. Author

N74-19764# Air Force Human Resources Lab., Wright-Patterson AFB, Ohio.
HUMAN RESOURCES AND PERSONNEL COST DATA IN SYSTEM DESIGN TRADEOFFS, AND HOW TO INCREASE DESIGN ENGINEER USE OF HUMAN DATA Final Report
William B. Askren Oct. 1973 20 p refs Presented at the 81st Ann. Conv. of the Am. Psychological Assoc., Montreal, 27-31 Aug. 1973
(AF Proj. 1124)
(AD-770737; AFHRL-TR-73-46) Avail: NTIS CSCL 05/9

A number of studies performed over a period of several years regarding the use of human resources and personnel cost data in system design tradeoffs were analyzed and the results integrated. Five questions were posed and answered. What are system design tradeoffs? What are human resources data? Why should military psychologists be interested in system design tradeoffs and human resources data? How much effect do system design tradeoffs have on human resources and personnel cost? And, what does this have to do with increasing engineer use of human data in design activities? The following conclusions were derived. Tradeoffs are a significant part of the weapon system design process. The choice of design alternative in a tradeoff study would, in many cases, substantially affect the human resources of the organization using the product of the design. It is feasible to use data describing these human resources in design tradeoffs. This use could lead to development of products which make less demand on those resources. Viewing system design as a human decision process involving choice points and options, gives the psychologist an orientation toward design which allows him to more effectively work with the engineer. Author (GRA)

N74-19765# Beta Industries, Inc., Dayton, Ohio.
AN INVESTIGATION OF AUTOMATIC RESTRAINT AND BODY POSITIONING TECHNIQUES Final Report, Oct. 1968 - Jun. 1970
Norman S. Phillips, Richard W. Carr, Thomas J. Wittmann, and Richard S. Scranton Dec. 1973 109 p refs
(Contract F33615-69-C-1099; AF Proj. 7231)
(AD-773857; BII-202-22; AMRL-TR-71-101) Avail: NTIS CSCL 06/7

A unique test apparatus was designed, fabricated and tested which will permit the study of performance limits of automatic restraint and body positioning systems. The program was initiated by a parametric analysis that established the relations that exist between those parameters that dictate the efficacy of an automated system. The study was followed by an investigation of design criteria related to escape sequence timing, optimum positioning, cockpit interface and human tolerance. These data were compiled and used with new principles and techniques of retraction and restraint and led to the design of an automatic test device. The fabricated device is a hydraulically operated system capable of retracting any body segment over its extreme range within 0.100 seconds. (Modified author abstract) GRA

N74-19766# Naval Air Development Center, Warminster, Pa. Crew Systems Dept.
US NAVY DEVELOPMENT OF A MISSION SPECIFIC FIGHTER HELMET Progress Report
Matthew J. Lamb 10 Dec. 1973 13 p
(AD-773756; NADC-73252-40) Avail: NTIS CSCL 06/1

The Naval Air Development Center is conducting a development program to provide a head protective system specifically designed to meet aircraft applications and mission profiles of the fighter community. The primary design criteria is to minimize the limitations imposed on the pilot's ability to proficiently perform in a high g environment. Author (GRA)

N74-19767# Naval Training Equipment Center, Orlando, Fla. Training Analysis and Evaluation Group.
TRAINING ANALYSIS OF P-3 REPLACEMENT PILOT AND FLIGHT ENGINEER TRAINING Final Report
Robert F. Browning, Leonard E. Ryan, and Paul G. Scott Dec. 1973 122 p refs
(AD-773745; TAEG-10) Avail: NTIS CSCL 05/9

This report is concerned with pilot and flight engineer training at the Replacement Squadron level. It presents the results of: an assessment of the training effectiveness of Operational Flight Trainer, and Cockpit Familiarization Trainer; field tryout of an experimental synthetic and flight syllabus for P-3 replacement pilot training; an economic analysis of the potential savings realizable from an improved instructional strategy; and an analysis of the current flight engineer training syllabus. The requirement for a state-of-the-art P-3C flight simulator incorporating a six-degree of freedom motion platform and a visual system is discussed as are additional tasks that may be trained in this simulator. (Modified author abstract) GRA

N74-19741 Joint Publications Research Service, Arlington, Va.
USE OF DIFFERENT METHODS FOR STUDYING SMALL GROUPS APPLICABLE TO GROUP SCREENING PROBLEMS
N. A. Gosudarev *In its* Space Biol. and Aerospace Med., Vol. 8, No. 1, 1974 (JPRS-61487) 15 Apr. 1974 p 80-87 refs Transl. into ENGLISH from Kosmich. biol. Aviakosmich. Med. (Moscow), v. 8, no. 1, Jan.-Feb. 1974 p 80-87 (For availability see N74-19730 11-04)

06 CHEMISTRY

Includes chemical analysis and identification (e.g. spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N74-19768*+ Institute for Research, Houston, Tex.
NEUTRON ACTIVATION ANALYSIS FOR ANTIMETABOLITES Final Report
29 Nov. 1973 38 p
(Contract NAS9-11940)
(NASA-CR-134221) Avail: NTIS HC $5.00 CSCL 07D

Determination of metal ion contaminants in food samples is studied. A weighed quantity of each sample was digested in a concentrated mixture of nitric, hydrochloric and perchloric acids to affect complete solution of the food products. The samples were diluted with water and the pH adjusted according to the specific analysis performed. The samples were analyzed by neutron activation analysis, polarography, and atomic absorption spectrophotometry. The solid food samples were also analyzed by neutron activation analysis for increased sensitivity and lower levels of detectability. The results are presented in tabular form. Author

N74-19769* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
METHOD AND APPARATUS FOR STABLE SILICON DIOXIDE LAYERS ON SILICON GROWN IN SILICON NITRIDE AMBIENT Patent
Ronald A. Cohen and Roy K. Wheeler, inventors (to NASA) Issued 12 Mar. 1974 3 p Filed 9 Sep. 1969 Supersedes N70-12627 (08 - 02, p 0237)
(NASA-Case-ERC-10073-1; US-Patent-3,796,592; US-Patent-Appl-SN-856253; US-Patent-Class-117-95) Avail: US Patent Office CSCL 07D

A method and apparatus for thermally growing stable silicon dioxide layers on silicon is disclosed. A previously etched and baked silicon nitride tube placed in a furnace is used to grow the silicon dioxide. First, pure oxygen is allowed to flow through the tube to initially coat the inside surface of the tube with a thin layer of silicon dioxide. After the tube is coated with the thin layer of silicon dioxide, the silicon is oxidized thermally in a normal fashion. If the tube becomes contaminated, the silicon dioxide is etched off thereby exposing clean silicon nitride and then the inside of the tube is recoated with silicon dioxide. As is disclosed, the silicon nitride tube can also be used as the ambient for the pyrolytic decomposition of silane and ammonia to form thin layers of clean silicon nitride.
Official Gazette of the U.S. Patent Office

N74-19770 Montana State Univ., Bozeman.
INTERACTIVE VOLTAMMETRIC INSTRUMENTATION FOR IDENTIFICATION OF CHLORINATED HYDROCARBONS AND THE DETERMINATION OF REDUCTION PATHWAYS

FOR SELECTED AROMATIC CHLORINE COMPOUNDS **Ph.D. Thesis**
Sherry Owen Farwell 1973 297 p
Avail: Univ. Microfilms Order No. 74-2063

Two electronic analytical instruments were constructed from integrated circuits for use in the voltammetric experiments. The first instrument was a programmable waveform generator that included analog derivatives of the current-voltage curves. The output capabilities of this versatile waveform generator are single and multiple triangular waves, sawtooth waves, ramps with variable holds, and combinations of these modes. The second instrument was specifically designed to provide a voltage ramp that is controlled by the electrochemical behavior of the electroactive sample. This apparatus causes a temporary interruption in the voltage sweep being applied to the electrochemical cell when a reduction peak is detected. The interrupted-sweep instrumentation is particularly advantageous in obtaining reproducible voltrammetric data for multi-reducible compounds that display overlapping reduction peaks. Dissert. Abstr.

N74-19771*# California Inst. of Tech., Pasadena. Dept. of Chemistry and Chemical Engineering.
STUDIES RELATED TO PRIMITIVE CHEMISTRY. A PRELIMINARY INVESTIGATION OF THE APPLICABILITY OF PROTON AND NITROGEN-14 NUCLEAR MAGNETIC RESONANCE TO THE CHARACTERIZATION OF INTERACTIONS BETWEEN AMINO ACID AND NUCLEIC ACID CONSTITUENTS AND A DISCUSSION OF PREVIOUS WORK ON THESE INTERACTIONS AND THEIR POSSIBLE RELATION TO PREBIOTIC SYNTHESIS OF BIOPOLYMERS **Final Report**
S. L. Manatt, E. A. Cohen, A. M. Shiller, and S. I. Chan 28 Dec. 1973 100 p refs
(Grant NGR-05-002-314)
(NASA-CR-138033) Avail: NTIS HC $8.00 CSCL 07C

Preliminary proton nuclear magnetic resonance (NMR) studies were made to determine the applicability of this technique for the study of interactions between monomeric and polymeric amino acids with monomeric nucleic acid bases and nucleotides. Proton NMR results for aqueous solutions (D2O) demonstrated interactions between the bases cytosine and adenine and acidic and aromatic amino acids. Solutions of 5'-AMP admixed with amino acids exhibited more complex behavior but stacking between aromatic rings and destacking at high amino acids concentration was evident. The multisite nature of 5'-AMP was pointed out. Chemical shift changes for adenine and 5'-AMP with three water soluble polypeptides demonstrated that significant interactions exist. It was found that the linewidth-pH profile of each amino acid is unique. It is concluded that NMR techniques can give significant and quantitative data on the association of amino acid and nucleic acid constituents. Author

N74-19772*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
[AROMATIC POLYIMIDE PREPARATION] **Patent Application**
Vernon L. Bell, inventor (to NASA) Filed 5 Mar. 1974 10 p
(NASA-Case-LAR-11372-1; US-Patent-Appl-SN-448321) Avail: NTIS HC $4.00 CSCL 07C

A method of preparing aromatic polyimides having uniquely low softening temperatures is described. By using meta-substituted aromatic diamines alone in homopolyimide preparation by reacting them with aromatic dianhydrides, homopolyimides are recoverable. They also are thermoplastic at such unusually low temperatures as to make them moldable and otherwise processible under more favorable conditions. NASA

N74-19773*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CATALYTIC TRIMERIZATION OF AROMATIC NITRILES FOR SYNTHESIS OF POLYIMIDE MATRIX RESINS
L.-C. Hsu 1974 14 p refs Presented at Symp. on New Ind. Polymers, Div. of Organic Coatings and Plastics Chem., 167th Spring Natl. Meeting of the Am. Chem. Soc., Los Angeles, 2 Apr. 1974
(NASA-TM-X-71525; E-7923) Avail: NTIS HC $4.00 CSCL 07D

Aromatic nitriles may be trimerized at moderate temperature and pressure with p-toluenesulfonic acid as catalyst. Studies were conducted to establish the effect of the reaction temperature, pressure, time, and catalyst concentration on yield of the trimerized product. Trimerization studies were also conducted to establish the effect of substituting electron donating or withdrawing groups on benzonitrile. Preliminary results of using the catalytic trimerization approach to prepare s-triazine cross-linked polyimide/graphite fiber composites are presented. Author

N74-19774*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SHOCK TUBE MEASUREMENTS OF SPECIFIC REACTION RATES IN BRANCHED CHAIN CH4-CO-O2 SYSTEM
T. A. Brabbs and R. S. Brokaw 1974 21 p refs Proposed for presentation at the 15th Intern. Symp. on Combust., Tokyo, 25-31 Aug. 1974
(NASA-TM-X-71534; E-7939) Avail: NTIS HC $4.25 CSCL 07D

Rate constants of two elementary bimolecular reactions involved in the oxidation of methane were determined by monitoring the exponential growth of CO flame band emission behind incident shocks in three suitably chosen gas mixtures. Author

N74-19775*# Kanner (Leo) Associates, Redwood City, Calif.
SYNTHESIS AND PROPERTIES OF POLYPHTHALIMIDES
Shunichiro Nishizaki Washington NASA Apr. 1974 15 p refs Transl. into ENGLISH from Kogyo Kagaku Zasshi (Tokyo), v. 69, no. 5, 1966 p 1069-1072
(Contract NASw-2481)
(NASA-TT-F-15453) Avail: NTIS HC $4.00 CSCL 07C

Attempts were made to synthesize polymers containing benzophenone and phthalimides and main chain repeating units. In a polar solvent, a reaction was performed of aromatic diamines with dianhydrides of tetracarboxylic acid obtained by oxidizing products of the Friedle-Crafts' reaction between orthoxylene and bis(chloromethyl) benzene and soluble phthalimidic acid polymers were obtained. These were converted into polyphthalimides by heating for 4 hours at 220 C, producing yellow, flexible films. Polyphthalamine was subjected to ring opening in an alkali aqueous solution, producing polyamidic acid salts. It was confirmed from the IR spectra that these turned into polyamidic acids when given acid treatment. The electrical properties of the polymers were measured, and the dielectric constant displayed a large value of 6.1-7.8. In measurements with a thermobalance, the pyrolysis in the air began at a temperature close to 350 C and was more or less completed at 500 C. Author

N74-19776*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ANALYSIS OF VOLATILE ORGANIC COMPOUNDS **Patent Application**
Albert Zlatkis, inventor (to NASA) (Houston Univ.) Filed 12 Mar. 1974 44 p
(Contracts NAS9-8260; NAS9-12093)
(NASA-Case-MSC-14428-1; US-Patent-Appl-SN-450500) Avail: NTIS HC $5.25 CSCL 07C

An improved system is described for reproducibly analyzing, both qualitatively and quantitatively, trace amounts of a large number of organic volatiles existing in a gas sample. Applications include: (1) analyzing the headspace gas of body fluids and comparing a profile of the organic volatiles with standard profiles for the detection and monitoring of disease, (2) analyzing the headspace gas of foods and beverages and comparing a profile of the organic volatiles with standard profiles so that flavor and aroma can be monitored and controlled, and (3) similar analysis for determining the organic pollutants in samples of water and air. The system includes a means (sample trap) for capturing and enriching the organic voltatiles, an injector port for directly injecting the entrapped organic volatiles to a cryogenic precolumn to provide a sharply defined plug, and a capillary separating column. Various detectors may be utilized to identify the separated volatiles. NASA

N74-19777*# Delaware State Coll., Dover. Dept. of Physics and Astronomy.
THE PHOTODETACHMENT CROSS-SECTION AND THRESHOLD ENERGY OF NEGATIVE IONS IN CARBON

DIOXIDE Progress Report
Ehsan M. Helmy and S. B. Woo (Delaware Univ., Newark) Mar. 1974 19 p refs
(Grant NGR-08-002-005)
(NASA-CR-138025) Avail: NTIS HC $4.00 CSCL 07D

Threshold energy and sunlight photodetachment measurements on negative carbon dioxide ions, using a 2.5 kw light pressure xenon lamp, show that: (1) Electron affinity of CO3(+) is larger than 2.7 e.V. and that an isomeric form of CO3(+) is likely an error; (2) The photodetachment cross section of CO3(-) will roughly be like a step function across the range of 4250 to 2500A, having its threshold energy at 4250A; (3) Sunlight photodetachment rate for CO3(-) is probably much smaller than elsewhere reported; and (4) The probability of having photodetached electrons re-attach to form negative ions is less than 1%. Mass identifying drift tube tests confirm that the slower ion is CO3(-), formed through the O(-) + 2CO2 yields CO3(-) + CO2 reaction. G.G.

N74-19778# Rice Univ., Houston, Tex. Dept. of Chemistry.
STUDIES OF SMALL ORGANIC MOLECULES IN SOLID FLUORINE
J. L. -F. Wang, Robert H. Hauge, and J. L. Margrave [1973] 17 p refs
Avail: NTIS HC $4.00 CSCL 07D

Direct and indirect fluorination are treated. For indirect fluorination, elements were introduced in organic molecules by means of fluorine containing reagents. A second method was introduced that involves the use of direct reaction of the gaseous fluorine with organic molecules under a variety of conditions. It was found that the gas combined with most carbon compounds essentially by combustion and often explosively. A low temperature matrix isolation technique was used to control and direct the powerful reactions of direct fluorination. Author

N74-19779# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Chemistry.
NUCLEAR CHEMISTRY AND GEOCHEMISTRY RESEARCH Progress Report, 1972 - 1973
Truman P. Kohman and Paul J. Karol 31 May 1973 60 p refs
(Contract AT(11-1)-3236)
(COO-3236-6) Avail: NTIS

Procedures for determining Nd-142/Nd-146, Nd-143/Nd-146, and Sm-144/Nd-146 ratios in 1g samples (meteorites and lunar samples) to 0.1% accuracy are outlined. NSA

N74-19780# Aerospace Corp., Los Angeles, Calif. Chemistry and Physics Lab.
THEORETICAL STUDIES ON N2 AND N2(+) Final Technical Report, 1 Sep. 1972 - 30 Jun. 1973
D. C. Cartwright and N. A. Fiamengo 30 Jun. 1973 91 p refs
(Contract F04701-72-C-0073)
(AD-773185) Avail: NTIS CSCL 07/4

This theoretical research is directed at determining more accurate and consistent theoretical models of the excitation, emission, and deactivation properties of N2(+) and N2 molecular band systems excited by electrons with eventual application to upper atmospheric processes. In preparation for performing quantitative calculations on the autoionization rates leading to the formation of N2(+), ab initio quantum mechanical calculations were carried out on the ground state of N2 and the doublet electronic states of N2(+). An accurate, yet computationally simple, wavefunction was obtained for the N2(X singlet sigma(+)g) state. The configuration interaction calculations that were carried out on the doublet states of N2(+) resulted in the identification of seven bound states not previously reported. Quantum mechanical calculations were also carried out on the Rydberg states of N2(+). Analysis of electron energy-loss spectra has resulted in the first determination of the excitation cross sections for valence states in N2 at 20 eV incident energy. GRA

N74-19781# Temple Univ., Philadelphia, Pa. Dept. of Chemistry.
PREPARATION AND PROPERTIES OF ONE-DIMENSIONAL METALS IN DIELECTRIC MATRICES Final Report
Mortimer M. Labes and Vernon V. Walatka, Jr. Nov. 1973 15 p refs
(Grant AF-AFOSR-2049-71; AF Proj. 9764)
(AD-772741; AFOSR-73-2318TR) Avail: NTIS CSCL 07/2

The aim of this research was to prepare monocrystals of several compounds possessing metallic chains which are one-dimensionally or two-dimensionally constrained and evaluate their electronic properties. Such structures have been suggested to be possible models for high temperature superconductors. One-dimensional platinum complexes, and channel complexes of iodine and polysulfur nitrides were grown. Two-dimensional intercalation complexes and polymerization of monomeric Lewis bases were prepared. The superconducting critical temperature was determined by measuring ac magnetic susceptibility as a function of temperature. Author (GRA)

N74-19782# General Electric Co., Philadelphia, Pa. Missile and Space Div.
SPECTROSCOPY OF METAL OXIDES
Milton J. Linevsky and Fred N. Alyea Nov. 1973 76 p refs
(Contract F30602-73-C-0102; AF Proj. 1649)
(AD-772752; RADC-TR-73-391) Avail: NTIS CSCL 07/4

The report discusses infrared studies of the seeding of one atmosphere cyanogen/oxygen flames with uranium hexafluoride. A single feature at 800/cm was observed, and shown to be due to either UO3, UO2 or UO. The value of the absolute band intensity was found. A flow reactor characterized by fast flow, rapid mixing and long optical pathlengths, was employed to study the oxidation kinetics of trimethyl aluminum (TMA). The usefulness of aluminum grenade releases for kinetic studies is explored. The intensity history of the continuum is discussed. Chemical kinetic models can be verified at times later than 15 seconds for altitudes above 120Km. A computer model for this purpose has been established and tested. (Modified author abstract) GRA

N74-19783# General Electric Co., Philadelphia, Pa. Reentry and Environmental Systems Div.
KINETICS AND MECHANISM IN THE OXIDATION OF THORIUM AND URANIUM Final Technical Report, Jan. - Jun. 1973
Peter Zavitsanos Oct. 1973 53 p refs
(Contract F30602-72-C-0412; ARPA Order 1649)
(AD-773197; RADC-TR-73-376) Avail: NTIS CSCL 07/4

The results of laboratory investigations which involve (1) the vaporization of thorium metal using rf heating, laser radiation heating by chemical reactions, and (2) the oxidation of thorium and uranium, are presented. It has been determined that the heat of vaporization for monoatomic thorium vapor is 143 Kcal/mole. the ionization potentials of thorium (gas) and thorium oxide (gas) are quite low (5.5 -6.0eV), while that of thorium dioxide (ThO2) is higher by 3eV. The rate constant for the production of thorium dioxide ion (ThO2-) was determined. The results of the laser blow-off study indicate that the spectrum from uranium metal produces both natural and singly ionized uranium atoms. (Modified author abstract) GRA

N74-19784# Army Foreign Science and Technology Center, Charlottesville, Va.
CALCULATION OF THE RETENTION INDICES IN PROGRAMMED TEMPERATURE GAS CHROMATOGRAPHY
L. Erdey and J. Takacs 16 Apr. 1973 5 p refs Transl. into ENGLISH from Magy. Kem. Folyoirat (Budapest), no. 1, 1970 p 49-50
(AD-772446; FSTC-HT-23-124-73) Avail: NTIS CSCL 07/4

The article discusses the calculation of retentive indices in programmed temperature gas chromatography and the need for further research in this area. GRA

N74-19785# Arizona Univ., Tucson. Dept. of Chemistry.
CROSS CORRELATION CHROMATOGRAPHY APPLIED TO GAS-SOLID ADSORPTION STUDIES Technical Report, 1 Sep. 1972 - 8 Jan. 1974
John B. Phillips and Michael F. Burke 8 Jan. 1974 20 p refs
(Contract N00014-67-A-0209-0014; NR Proj. 051-518)
(AD-772552; TR-2) Avail: NTIS CSCL 07/4

The use of cross correlation techniques on multiple injection

gas chromatography as a means to describe gas-solid interactions has been demonstrated. A deconvolution technique using the Fourier transform of both the cross correlation of the output and the auto correlation of the input series has been developed. The deconvolution allows the differentiation between correlation noise due to an imperfectly random input series and actual correlation peaks due to column interaction. The relationship between sample size and the resulting column overloading and the size of secondary correlation peaks is discussed.
Author (GRA)

N74-19786# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A LASER CONTROLS A CHEMICAL REACTION
A. I. Nikitin 11 Dec. 1973 7 p refs Transl. into ENGLISH from Priroda (Moscow), no. 9, 1971 p 77-78
(AD-773278; FTD-HT-23-499-74) Avail: NTIS CSCL 07/5
Chemical lasers which use the energy of exothermic reactions are becoming a tool to control the course of a chemical reaction. GRA

N74-19787# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
GROUP AND SUCCESSIVE PAIR COLLISIONS DURING SCATTERING OF Cs(+) IONS BY A TUNGSTEN SINGLE CRYSTAL
V. I. Veksler and V. V. Evstifeev 15 Jan. 1974 20 p refs Transl. into ENGLISH from Zh. Eksperim. Teor. Fiz. (Moscow), v. 64, no. 2, 1973 p 568-575
(AD-773290; FTD-HT-23-751-74) Avail: NTIS CSCL 07/4
The fine structure of the energy spectra of Cs(+) ions scattered by the (110), (001) and (112) faces of a tungsten single crystal is investigated under conditions of sufficiently high angular and energy resolution. Angular dependences of the energy corresponding to various peaks in the scattered ion spectrum of angle of incidence of the primary ions on the target surface for a given scattering angle are derived. The model of group interaction between an ion and four or three lattice atoms and the model of pair double or triple collisions are invoked for explaining the shifts of the bell-shaped curve peaks along the incidence angle scale for various scattering atomic directions. GRA

N74-19739 Joint Publications Research Service, Arlington, Va.
SYNTHESIS OF METHYL ALCOHOL FROM CARBON DIOXIDE AND HYDROGEN FOR REPRODUCING ARTIFICIAL SUGARS
M. G. Rozenfeld, M. T. Rusov, S. K. Sachenko, and Yu. Ye. Sinyak *In its* Space Biol. and Aerospace Med., Vol. 8, No. 1, 1974 (JPRS-61487) 15 Apr. 1974 p 67-74 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), v. 8, no. 1, Jan.-Feb. 1974 p 47-53 (For availability see N74-19730 11-04)

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N74-19788* National Aeronautics and Space Administration. Pasadena Office, Calif.
GATED COMPRESSOR, DISTORTIONLESS SIGNAL LIMITER Patent
Raymond C. Woodbury, inventor (to NASA) (JPL) Issued 26 Mar. 1974 7 p Filed 28 Jun. 1972 Supersedes N72-28166 (10 - 19, p 2526) Sponsored by NASA
(NASA-Case-NPO-11820-1; US-Patent-3,800,237; US-Patent-Appl-SN-266912; US-Patent-Class-328-168; US-Patent-Class-328-160; US-Patent-Class-328-172; US-Patent-Class-333-14; US-Patent-Class-307-237) Avail: US Patent Office CSCL 17B
A distortionless gated compressor for limiting the amplitude of a signal so as not to produce undesired signal levels responsive thereto is disclosed. The gated compressor includes a distortionless multiplier which multiplies an AC signal from a factor defined by a DC control signal. The compressor includes a plurality of channels each responsive to a signal produced in response to the multiplier's output. When the signal supplied to any channel exceeds a prescribed level, the level of the DC control signal is reduced to reduce the multiplier's output level and thereby prevent the signal applied to any channel from exceeding its prescribed level. Official Gazette of the U.S. Patent Office

N74-19789 Post Office Research Dept., London (England). Research Dept.
AN INTRODUCTION TO THE THEORY OF DIGITAL FILTERS
J. M. Linke 28 Mar. 1972 31 p refs
(Rept-276) Copyright. Avail: Issuing Activity
Digital filters are a fairly recent innovation. They simulate conventional filters by numerical manipulation of signal samples. Many disciplines have contributed to the concepts involved. These are formulated and linked to those of the more familiar areas of network and control theory. Flow diagrams are introduced and their characterization by pulse transfer functions derived. Methods of finding design parameters are briefly discussed and the effects on non-linearity, inherent in all numerical processes, described. Author

N74-19790* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AUTOMATIC FREQUENCY CONTROL FOR FM TRANSMITTER Patent
Martial A. Honnell, inventor (to NASA) (Auburn Univ.) Issued 26 Mar. 1974 7 p Filed 20 Feb. 1973 Supersedes N73-18177 (11 -09, p 1002) Sponsored by NASA
(NASA-Case-MFS-21540-1; US-Patent-3,800,224; US-Patent-Appl-SN-333912; US-Patent-Class-325-148; US-Patent-Class-178-7.1) Avail: US Patent Office CSCL 17B
An automatic frequency control circuit for an FM television transmitter is described. The frequency of the transmitter is sampled during what is termed the back porch portion of the horizontal synchronizing pulse which occurs during the retrace interval, the frequency sample compared with the frequency of a reference oscillator, and a correction applied to the frequency of the transmitter during this portion of the retrace interval.
Official Gazette of the U.S. Patent Office

N74-19791 Case Western Reserve Univ., Cleveland, Ohio.
CHARACTERISTICS OF AN IM/FM LASER COMMUNICATION SYSTEM Ph.D. Thesis
Jonathan Paul Freeman 1973 156 p
Avail: Univ. Microfilms Order No. 74-2513
Laser communication systems using an IM/FM (intensity modulated/frequency modulated) format provide a feasible method for transmission of video bandwith signals through the turbulent atmosphere. Three major areas are discussed. First, an IM/FM system is modeled and operating equations are developed which show the system's ability at overcoming atmospheric scintillation characteristics. Secondly, performance criteria and capabilities are theoretically developed and optimization of parameter techniques such as modulator bias and deviation ratio are presented. Finally, a successful comparison is made between an experimental IM/FM system and the performance theory. The experimental system used a photomultiplier tube and operated in a shot noise limited mode for received optical power corresponding to high atmospheric attenuation, and in a thermal noise limited mode for received optical powers corresponding to low atmospheric attenuation.
Dissert. Abstr.

N74-19792 Michigan Univ., Ann Arbor.
TRANSIENT RADIATION FROM RESISTIVELY LOADED TRANSMISSION LINES AND THIN BICONICAL ANTENNAS Ph.D. Thesis
Harold Edwin Foster 1973 149 p
Avail: Univ. Microfilms Order No. 74-3627
A theoretical analysis is presented of the radiation and reception of transient electromagnetic signals by resistively loaded transmission lines and thin biconical antennas. The resistively loaded transmission line analysis, in addition to providing an advance in its own right, supplies a basis for the study of transients in antennas. Transmission line theory and mechanisms apply to

the modeling of a variety of antennas and to the detailed understanding of their performance. The transient analysis is attached by the Fourier transform approach to make use of established concepts such as that of impedance. Investigations are performed first in the frequency domain and then transformed into the time domain for inspection of transient results. The Fast Fourier Transform technique of truncating series of sinusoids provides some economy where numerical computations are needed for the transformations. General transmission line equations are developed to account for time-dependent and position-dependent transmission line parameters. Dissert. Abstr.

N74-19793*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Electrical Engineering.
SYNTHESIS OF MULTIPLE SHAPED BEAM ANTENNA PATTERNS Final Report
W. L. Stutzman and E. L. Coffey 31 Aug. 1973 188 p
(Grant NGR-47-004-103)
(NASA-CR-138982) Avail: NTIS HC $12.50 CSCL 20N

Results are presented of research into the problem of finding an excitation of a given antenna such that the desired radiation pattern is approximated to within acceptable limits. This is to be done in such a fashion that boundary conditions involving hardware limitations may be inserted into the problem. The intended application is synthesis of multiple shaped beam antennas. Since this is perhaps the most difficult synthesis problem an antenna engineer is likely to encounter, the approach taken was to include as a by-product capability for synthesizing simpler patterns. The synthesis technique has been almost totally computerized. The class of antennas which may be synthesized with the computer program are those which may be represented as planar (continuous or discrete) current distributions. The technique is not limited in this sense and could indeed by extended to include, for example, the synthesis of conformal arrays or current distributions on the surface of reflectors. The antenna types which the program is set up to synthesize are: line source, rectangular aperture, circular aperture, linear array, rectangular array, and arbitrary planar array. Author

N74-19794*# Boston Univ., Mass.
[EXPLORING THE POSSIBILITY OF FOLLOWING THE MOVEMENTS OF A BIRD FROM AN ARTIFICIAL EARTH SATELLITE] Final Report
R. Stuart Mackay Feb. 1974 2 p refs
(Grant NGR-22-004-024)
(NASA-CR-137369) Avail: NTIS HC $4.00 CSCL 17B

The development of a harness to hold the transmitter is discussed along with satellite systems for monitoring the flight paths of the birds, and incorporating biological information into the tracking signal. K.M.M.

N74-19795*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
STATUS OF AVAILABILITY OF MARINER 9 (1971-051A) TV PICTURE DATA Data Announcement Bulletin
Mar. 1974 17 p
(NASA-TM-X-69982; NSSDC-74-05-Suppl-1) Avail: NTIS HC $4.00 CSCL 09F

Request procedures are described for Mariner 9 TV picture data. Image processing laboratory, user's guides, mosaics, catalogues, and microfiches are briefly discussed. Samples of the limb picture microfiche index and catalogue are presented. J.A.M.

N74-19796*# Hughes Aircraft Co., El Segundo, Calif. Space and Communications Group.
TECHNOLOGY FORECASTING FOR SPACE COMMUNICATION Final Report
Jun. 1973 508 p
(Contract NAS5-22057)
(NASA-CR-132936; SCG-40001R) Avail: NTIS HC $28.50 CSCL 17B

A study was conducted to determine techniques for application to space communication. The subjects considered are as follows: (1) optical communication systems, (2) laser communications for data acquisition networks, (3) spacecraft data rate requirements, (4) telemetry, command, and data handling, (5) spacecraft tracking and data network antenna and preamplifier cost tradeoff study, and (6) spacecraft communication terminal evaluation. For individual titles, see N74-19797 through N74-19802.

N74-19797* Hughes Aircraft Co., El Segundo, Calif. Space and Communications Group.
EXECUTIVE SUMMARY **c07**
In its Technology Forecasting for Space Communication Jun. 1973 28 p refs (For availability see N74-19796 11-17)
(SCG-40000R; C7022) CSCL 17B

The scope of Technology Forecasting for Space Communications is very wide, covering virtually every technology that can directly or indirectly affect space communications. The assigned effort, however, was directed toward a series of studies which individually examined important aspects of space communications and which collectively was interrelated. The contributions of the individual tasks and their interrelationship are indicated. The total effort of the tasks was fairly evenly divided between laser oriented and radio frequency tasks. The investigations show that laser communications have a current state of the art which would allow operational systems to be implemented in the 1975 to 1980 time frame. Further, these systems, when operated over ranges in the order of synchronous ranges (42,000 km)and transmitting data rates of 10 to the 8th power 10 to the 9th power bits per second will have a smaller total weight impact on a spacecraft than do radio systems. Author

N74-19798* Hughes Aircraft Co., El Segundo, Calif. Space and Communications Group.
TASK ONE REPORT: OPTICAL SYSTEM STUDY **c16**
In its Technology Forecasting for Space Communication Jun. 1973 61 p (For availability see N74-19796 11-07)
(SCG-20669R) CSCL 20E

An optical system which can be incorporated in a present day or near future space-borne laser communications system is described. Techniques of implementing these systems are presented and their design problems and use are discussed. Optical system weight is estimated as a function of aperture diameter for a typical present day or near future laser communication system. The optical communications system considered is a two-way, high data rate optical communications link from a spacecraft to a spacecraft or from a spacecraft to a ground station. Each station has a laser transmitter and receiver and a pointing and tracking system. Thus each station can track the laser transmitter of the other. Optical beamwidths are considered to be as small as an arc-second with the beam pointed to a fraction of this beamwidth. Author

N74-19799* Hughes Aircraft Co., El Segundo, Calif. Space and Communications Group.
TASK THREE: REPORT: STDN ANTENNA AND PREAMPLIFIER COST TRADEOFF STUDY **c09**
In its Technology Forecasting for Space Communication Jun. 1973 124 p refs (For availability see N74-19796 11-07)
(SCG-30195R) CSCL 09A

The general goal of this task, STDN Antenna and Preamplifier G/T Study, was to determine cost-effective combinations of antennas and preamplifiers for several sets of conditions for frequency, antenna elevation angle, and rain. The output of the study includes design curves and tables which indicate the best choice of antenna size and preamplifier type to provide a given G/T performance. The report indicates how to evaluate the cost effectiveness of proposed improvements to a given station. Certain parametric variations are presented to emphasize the improvement available by reducing RF losses and improving the antenna feed. Author

N74-19800* Hughes Aircraft Co., El Segundo, Calif. Space and Communications Group.
TASK FOUR REPORT: TELEMETRY, COMMAND, AND DATA HANDLING
In its Technology Forecasting for Space Communication Jun. 1973 112 p refs (For availability see N74-19796 11-07)
(SCG-30174R) CSCL 09F

An overview of the telemetry, command, and data handling features of four spacecraft developed under GSFC management is presented. Two of these spacecraft ATS and SMS, are designed for geostationary orbit; the other two OSO and ERTS, are designed for low earth orbits. The program time spans for these spacecraft

are as shown. The programs are seen to be near contemporary, especially in the 1973, 1974 period. All of the spacecraft listed were developed under GSFC control and are thus subject to the standards set forth in the Aerospace Data System Standard developed by GSFC. These standards must be adhered to by all spacecraft programs under GSFC control or utilizing STDN unless waivers have been granted. The standards were developed to maximize the utilization of the large amount of standard equipment at each STDN ground facility. The standards impose bounds on both the command and telemetry formats to be compatible with the STDN ground station unless valid and acceptable reasons are raised to deviate from these restraints. Author

N74-19801* Hughes Aircraft Co., El Segundo, Calif. Space and Communications Group.
TASK FIVE REPORT: LASER COMMUNICATIONS FOR DATA ACQUISITION NETWORKS c16
In its Technology Forecasting for Space Communication Jun. 1973 104 p (For availability see N74-19796 11-07)
(SCG-20706M) CSCL 20E

Laser communication technology and laser communication performance are reviewed. The subjects discussed are: (1) characteristics of laser communication systems, (2) laser technology problems, (3) means of overcoming laser technology problems, and (4) potential schedule for including laser communications into data acquisition networks. Various types of laser communication systems are described and their capabilities are defined. Author

N74-19802* Hughes Aircraft Co., El Segundo, Calif. Space and Communications Group.
TASK SIX REPORT: SPACECRAFT COMMUNICATION TERMINAL EVALUATION
In its Technology Forecasting for Space Communication Jun. 1973 76 p (For availability see N74-19796 11-07)
(SCG-30216R) CSCL 17B

An analytical comparison is made of space communication accomplished at six different wavelengths. In the radio band, 2.25, 7.5, and 14.5 GHz systems are analyzed, while at optical wavelengths, 0.53, 1.06 and 10.6 micron systems are examined. The purpose of the comparison is to determine which of these systems will require the least hardware weight to perform a given communication task. The problem is solved by requiring each communication system to meet a given performance while selecting combinations of transmitted power and antenna diameter to obtain the least overall system weight. This performance is provided while maintaining practical values for parameters other than antenna diameter and power, which also affect system performance. The results of the analysis indicate that for future data links over ranges of 42,000 to 84,000 km and with data bandwidths of 100 to 1000 MHz, the CO2 laser system will provide the required performance with the least total system weight impact on a spacecraft. Author

N74-19803*# Hughes Aircraft Co., El Segundo, Calif. Space and Communications Group.
TECHNOLOGY FORECASTING FOR SPACE COMMUNICATION: EXECUTIVE SUMMARY
Jun. 1973 29 p
(Contract NAS5-22057)
(NASA-CR-132935; SCG-40000R; Hughes-Ref-C7022) Avail: NTIS HC $4.50 CSCL 17B

Technology forecasting was used to examine the possibility of transferring laser and radio frequency communication techniques to space communication. E.H.W.

N74-19804*# Environmental Research Inst. of Michigan, Ann Arbor. Radar and Optics Div.
MULTI-FREQUENCY FINE RESOLUTION IMAGING RADAR INSTRUMENTATION AND DATA ACQUISITION Final Report, 1 Jun. 1970 - 15 Jan 1973
R. A. Rendleman, E. B. Champagne, J. E. Ferris, C. L. Liskow, J. M. Marks, and R. J. Salmer Feb. 1974 46 p
(Contract NAS9-11306)
(NASA-CR-134212; ERIM-198200-1-F) Avail: NTIS HC $5.50 CSCL 17I

Development of a dual polarized L-band radar imaging system to be used in conjunction with the present dual polarized X-band radar is described. The technique used called for heterodyning the transmitted frequency from X-band to L-band and again heterodyning the received L-band signals back to X-band for amplification, detection, and recording. Author

N74-19805*# Techtran Corp., Glen Burnie, Md.
SMS OPERATIONS-EQUIPMENT PREPARATION
Washington NASA Mar. 1974 27 p Transl. into ENGLISH from Compte Rendu D'Essai Tech. (Toulouse), 1973 33 p
(Contract NASw-2485)
(NASA-TT-F-14763; Rept-9413/73/008) Avail: NTIS HC $4.50 CSCL 17B

Various equipments connected with planned SMS telemetry operations in cooperative CNES-NASA venture were exercised and tested for interoperability. The test configuration and operational set up at the Brazzaville station are described. Minor difficulties encountered are reported. Author

N74-19806*# National Aeronautics and Space Administration. Pasadena Office, Calif.
ASYNCHRONOUS, MULTIPLEXING, SINGLE LINE TRANSMISSION AND RECOVERY DATA SYSTEM Patent Application
Tage O. Anderson, inventor (to NASA) (JPL) Filed 27 Mar. 1974 24 p
(Contract NAS7-100)
(NASA-Case-NPO-13321-1; US-Patent-Appl-SN-455163) Avail: NTIS HC $4.25 CSCL 17B

A transmission system for asynchronously communicating binary data from a plurality of satellite sampling locations to a central location over a single channel, unidirectional communication line is presented. The novelty of the invention appears to reside in the employment of dual satellite message frames from each one of a plurality of satellite locations. The pairs of frames are asynchronously multiplexed with other frame pairs on a single, unidirectional transmission line connected to a remote location. Employment of these dual message frames in an asynchronous environment provides sufficient information at the remote location to guarantee synchronization and demultiplexing by signals derived from the received data frames. The techniques of this invention provide simplified and reliable circuitry at the plurality of satellite locations. NASA

N74-19807*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NASACOM NETWORK GROUND COMMUNICATIONS RELIABILITY REPORT
Feb. 1974 65 p
(NASA-TM-X-70616; X-843-74-56) Avail: NTIS HC $6.25 CSCL 17B

A reliability performance analysis was made of the NASCOM Network circuits. A Network performance narrative summary is presented including significant changes in circuit configurations, current month's figures with significant factors, and a discussion of trends in each trouble category with notable circuit totals specified. This is followed by lost time and interruption tables listing circuits which were affected by outages showing their totals by trouble categories. Other tables and graphs present current and prior months' figures on circuit mode totals, network lost time, network reliabilities, numbers of stations, and circuits. A list is presented that shows the circuits that did not meet the NASCOM performance objectives, followed by a discussion of circuits that fell appreciably below these objectives. A narrative of individual circuit performance, is given only for those circuits whose reliabilities fell below 99.5 percent. Along with this, a special analysis of circuits whose reliabilities were low for three months or more is given, with tables depicting three month's performance and graphs of individual path reliabilities. Author

N74-19808*# Linguistic Systems, Inc., Cambridge, Mass.
COMPRESSION OF DATA AND ACCURACY OF RESTORATION OF ANALOG SIGNALS
V. P. Yevdokimov Washington NASA Mar. 1971 20 p refs Transl. into ENGLISH of "Szhatiyiye Dannykh i Tochnost Vosstanovleniya Analogovykh Signalov", Acad. of Sci., Inst. of Space Res., Moscow, report PR-136, 1973 21 p
(Contract NASw-2482)
(NASA-TT-F-15291; PR-136) Avail: NTIS HC $4.00 CSCL

17B

Discussed is the restoration of the shape of analog signals according to discrete readings passed through polynomial compression devices. Various models of the signal are employed, differing in the shape of the correlation function. The accuracy criteria are the mean square error of restorations in the middle of the interval between responses, at the edge of the interval, and the average over the interval. Calculations are performed of the errors in the restoration of the shape and the compression coefficients for different numbers of interrogation points in the correlation interval and the transitional threshold in the compression structures. The analysis was carried out with the aid of simulation of the signals and compression devices on a computer. Author

N74-19809*# Princeton Univ., N.J. Dept. of Electrical Engineering.
ADVANCED COMMUNICATIONS TECHNIQUES Final Technical Report
L. D. Davisson and M. E. VanValkenburg 28 Mar. 1972 5 p
(Grant NGR-31-001-068)
(NASA-CR-138981) Avail: NTIS HC $4.00 CSCL 17B

Research results obtained under the Advanced Communications Techniques grant are introduced through a list of lectures and papers. E.H.W.

N74-19810 Japan Broadcasting Corp., Tokyo. Information Processing Research Group.
SPOKEN DIGIT RECOGNITION USING MULTI-CATEGORY LINEAR DISCRIMINANT FUNCTION
Teruo Yasuhiro Dec. 1973 10 p refs
(NHK-173) Avail: NTIS HC $4.00

Speech recognition of a limited vocabulary in real times was studied. A few parameters which represent vowel features were extracted from the output of a filter bank (Gaussian characteristics with Q = 2) utilizing a multi-category linear discriminant function. The plane constructed from the first two of the parameters was found to give a good approximation to the F sub 1 - F sub 2 diagram. This plane was applied to real time spoken digit recognition, the correct recognition rate being 80% without learning. Author

N74-19811 Japan Broadcasting Corp., Tokyo. Program Engineering Research Group.
MINIATURE AND LIGHTWEIGHT CLOSE-TALKING MICROPHONE
Akio Mizoguch Oct. 1973 9 p
(NHK-172) Avail: NTIS HC $4.00

Attempts to develop miniature light weight close talking microphones are reported. Data on the laboratory prototypes SL-201 and CL-202 are given E.H.W.

N74-19812 Japan Broadcasting Corp., Tokyo. Radio Frequency Engineering and Satellite Broadcasting Research Group.
STATISTICS OF ATTENUATION DUE TO PRECIPITATION OF RADIO WAVES IN 12 GHz BAND AT HIGHER ANGLES OF ELEVATION
Akira Kinase and Akira Kinpara Oct. 1973 23 p refs
(NHK-171) Avail: NTIS HC $4.25

Several features of practical interest among the rainfall attenuation characteristics at higher angles of elevation are described on the basis of a collective analysis of all basic data, at three different sites, of measurements performed so far. Statistics of rainfall attenutation characteristics at these sites are presented numerically. In the light of the results thus obtained from the collective analysis, an approach is proposed to the derivation of a practical generalized prediction method for the characteristic in question at a given site. Author

N74-19813*# Clark (David) Co., Inc., Worcester, Mass.
SKYLAB COMMUNICATIONS CARRIER 16536G AND FILTER BYPASS ADAPTER ASSEMBLY 12535G Final Report
4 Mar. 1974 20 p
(Contract NAS9-12928)
(NASA-CR-134220; DCR-SiC-2944-00) Avail: NTIS HC $4.00 CSCL 17B

Communications equipment for use with the Skylab project is examined to show compliance with contract requirements. The items of equipment considered are: (1) communications carrier assemblies, (2) filter bypass adapter assemblies, and (3) sub-assemblies, parts, and repairs. Additional information is provided concerning contract requirements, test requirements, and failure investigation actions. Author

N74-19814# Control Data Corp., Minneapolis, Minn.
MODULAR DESIGN FOR RADAR COMPARATIVE ANALYSIS, VOLUME 2 Final Report
G. R. Allen Aug. 1973 77 p refs
(Contract F30602-72-C-0358)
(AD-771767; RADC-TR-73-222-Vol-2) Avail: NTIS CSCL 17/9

The development of a special purpose computing unit called the Flexible Processor designed for use in side-looking radar image processing systems is described in this two-volume report. Recent hardware developments have demonstrated on-line digital change detection, using special purpose computing logic sections which achieve an image processing speed capability in excess of one-hundred times that of large general purpose computers. This early equipment is reviewed and compare[illegible] a modular design concept based on the use of several Fie[illegible]sors, which work together to implement the image processing algorithms. This volume contains the detailed logic description and the instruction formats. GRA

N74-19815# Bendix Field Engineering Corp., Columbia, Md.
FEASIBILITY STUDY FOR A NON-PRINTING PORTABLE TELETYPE Final Report
Philip R. Sheridan Nov. 1973 30 p
(Contract DAAD05-72-C-0132)
(AD-772946; LWL-CR-06EA73) Avail: NTIS CSCL 17/2

The report describes the feasibility study of a visual message terminal (non-printing portable teletype) which is envisioned as a small, lightweight communications device that would attach to Army voice radios and allow communications without the generation of audible sounds. The device would be teletype compatible and would store its messages in internal logic circuitry and display them on a lighted display. The study concludes that a system to accomplish the above is indeed feasible and could be fabricated from components available with the present technology. The system would consist of a small size, teletype-formatted keyboard for data entry into the system. The display would consist of a 96-character LED display. Once the message is inputed into the unit, it would be transmitted out at a higher rate for burst transmissions over audio lines. (Modified author abstract) GRA

N74-19816# Michigan Univ., Ann Arbor. Radiation Lab.
THE COMPUTATION OF HIGH FREQUENCY SCATTERING Final Report, 1 Jan. - 30 Jun. 1973
Eugene F. Knott and Thomas B. A. Senior Sep. 1973 32 p refs
(Contract F19628-73-C-0126; AF Proj. 5635)
(AD-772737; Rept-011758-1-F; AFCRL-TR-73-0588) Avail: NTIS CSCL 20/14

The main purpose of the research was the development of computationally effective and efficient techniques for predicting high frequency scattering. A method is described for combining physical optics with first order diffraction theory and the effectiveness of the resulting program is demonstrated using data for a cone, cone-cylinder and cone-cylinder-flare. Other analytical and experimental investigations were also performed aimed at increasing the accuracy of the underlying theoretical model and some of the possible improvements and extensions of the computer program are indicated. GRA

N74-19817# Ohio State Univ., Columbus. ElectroScience Lab.
MEASUREMENT AND ANALYSIS OF SPECTRAL SIGNATURES Final Technical Report, Aug. 1972 - Aug. 1973
J. D. Young and W. L. Ko Nov. 1973 257 p
(Contract F30602-72-C-0204; AF Proj. 4506)
(AD-773181; ESL-3387-1; RADC-TR-73-304) Avail: NTIS CSCL 17/9

Complex radar cross-section measurements were made at ten harmonically-related frequencies on a set of target models resembling space objects. The frequencies used (1.08, 2.16,

3.24 ... 10.8 GHz) lay in the resonance region of the target scattering characteristics. By Fourier synthesis, the approximate ramp response of these targets can be constructed. The behavior of these ramp response waveforms vs. radar look angle and interrogating signal polarization is discussed. An interactive target imaging process was developed to use ramp response data at three orthogonal look angles. Techniques for image generation using short pulse radar data and three or five resonance region harmonics were investigated. Images are presented for some of the targets using measured short pulse and harmonic data. (Modified author abstract) GRA

N74-19818# RCA International Service Corp., Patrick AFB, Fla. Missile Test Project.

SELF-CALIBRATION OF LAND-BASED PULSE RADAR FROM SATELLITE TRACK

John J. OConnor and Robert R. Rowe Dec. 1973 18 p refs
(Contract F08606-72-C-0030)
(AD-773156; AFETR-TR-73-2) Avail: NTIS CSCL 17/9

The report describes a radar calibration procedure currently in use at the Air Force Eastern Test Range (AFETR) - a procedure which uses only a single radar's own passive tracking data of two successive passes of a satellite in conjunction with the theoretical equations of motion, known physical constants and associated computer program. No external tracking data or externally computed ephemeris is involved. Under routine conditions the zero-set biases and mislevel are estimated to an accuracy of 20 feet in range and 0.03 milliradians in angles. Under good conditions five other radar error model coefficients can be determined to comparable accuracy. The present maintained accuracy level of the AFETR radars is described. Author (GRA)

N74-19819# Army Missile Command, Redstone Arsenal, Ala. Advanced Sensors Directorate.

RANDOM SURFACE GENERATION FOR DIGITAL RADAR SIMULATION

Sam O. Dunlap 20 Nov. 1973 32 p refs
(DA Proj. 1X3-64307-D-212)
(AD-772953; RE-73-36) Avail: NTIS CSCL 17/9

The report presents a method of generating digital computer models of rough surfaces. It involves the linear filtering of a two-dimensional sample of white Gaussian noise to produce a two-dimensional surface with Gaussian probability density and autocorrelation function. The filter derivation, specific examples, and a computer listing are provided. Author (GRA)

N74-19820# Aerospace Corp., El Segundo, Calif.

SYNTHETIC APERTURE RADAR USING RANDOM SIGNALS. PART 1: DISCRETE ARRAYS

K. W. Moran, Jr. and G. R. Cooper (Purdue Univ., Lafayette) 30 Nov. 1973 24 p refs
(Contracts F04701-73-C-0074; DAAB07-67-C-0409; N00163-68-C-0106)
(AD-772704; TR-0074(4901-02)-1-Pt-1; SAMSO-TR-73-392-Pt-1) Avail: NTIS CSCL 17/9

The report introduces a signal processor structure for synthetic array processing in conjunction with a random signal radar. Displayed in its elemental form, the processor configuration consists of a bank of cross-correlators followed by a tapped delay line. Each correlator reference input is delayed an amount appropriate to focus the synthetic array, and the delay line taps are spaced in accordance with synthetic array element positions. The system is particularly characterized by a complete absence of range and azimuth ambiguities and its capability of operating in real time. It is shown that this system exhibits azimuth resolution properties similar to those of conventional synthetic aperture radar systems. Author (GRA)

N74-19821# General Electric Co., Syracuse, N.Y. Electronics Lab.

NARAL CLUTTER AND PROPAGATION EXPERIMENTS Final Report, Jul. 1972 - Sep. 1973

L. C. Humphrey, C. R. Roberts, E. R. Wingrove, and C. Younger Nov. 1973 129 p refs
(Contract F30602-73-C-0080)
(AD-773851; RADC-TR-73-333) Avail: NTIS CSCL 17/9

An experimental program that yields basic propagation and clutter data, using the NARAL radar (and other RADC high performance radars) is described. The resultant data can be used to determine the environmental limits to the capability of high performance radars. A collection of experiments which provide the data required to determine these environmental limitations, is presented. These experiments are of three categories: (1) Tropospheric; (2) Ionospheric; and (3) Ground and Miscellaneous Scatter. Each experiment contains the pertinent analysis and experimental requirements, and a description of the basic concept. (Modified author abstract) GRA

N74-19822# Army Electronics Command, Fort Monmouth, N.J.

HIGH FREQUENCY RADIO EMISSION AND RECEPTION BY FOREST TREES AND BY HELICOPTER USING HYBRID ELECTROMAGNETIC ANTENNA COUPLERS

Kurt Ikrath, William Kennebeck, and Kenneth J. Murphy Dec. 1973 78 p refs
(DA Proj. 1T0-61101-A-91A)
(AD-773909; ECOM-4173) Avail: NTIS CSCL 09/5

Measurements by helicopter of 5.750 MHz radiation patterns from closely-spaced hemac-coupled forest trees and from a 24-foot high marine whip antenna at the same forest site show that the directivities of high-frequency skywave radiation from the trees and from the whip are controlled by the local forest structure. By operating these closely-spaced trees as a phased twin-tree XMTR array, control over the elevation of the maximal radiation lobes is gained by the radio operator, while the local forest structure remains in control of the geographic azimuth angles of the radiation minima. Analogous to the exploitation of forest trees as antennas, the body of the helicopter was used as an antenna by means of a hemac wrapped around its tail section. (Modified author abstract) GRA

N74-19823# Radio Corp. of America, Moorestown, N.J. Missile and Surface Radar Div.

SYNCHRONOUS SATELLITE TRACKER INVESTIGATION Final Report, 23 Feb. 1972 - 21 May 1973

S. D. Gross and J. Liston Nov. 1973 252 p refs
(Contract F30602-72-C-0225)
(AD-773 .48; RADC-TR-73-277) Avail: NTIS CSCL 17/9

The study provides a design analysis and cost optimization on a phase array radar capable of detecting and tracking targets located at synchronous altitudes and beyond. The report describes parametric radar performance and cost models for several generic radar systems which were sized and optimized to satisfy the above requirements. The results of a parametric cost comparison among the various candidates is given and design detail and preliminary absolute cost data are presented for two system candidates selected for further study. These candidates are: (1) a phase-phase steered VHF (140 MHz) radar configuration which uses a tetrode (EIMAC 4CPX250K) power amplifier module per element in the transmit array and (2) a UHF (435 MHz) time scanned array radar (TSAR) configuration. Author (GRA)

N74-19824# California Inst. of Tech., Pasadena. Antenna Lab.

TRANSIENT RADIATION FROM COAXIAL WAVEGUIDE AND CYLINDRICAL MONOPOLE ANTENNAS

Norval L. Broome Nov. 1973 191 p refs
(Grant AF-AFOSR-1935-70; AF Proj. 9768)
(AD-773359; AFOSR-74-0070TR; TR-67) Avail: NTIS CSCL 09/5

The coaxial waveguide antenna is treated by the Wiener-Hopf technique and the transient radiation from a cylindrical monopole is developed in the light of the rigorous results obtained from the Wiener-Hopf analysis. Analytic expressions are derived for (1) the electromagnetic fields in the feed line and (2) the far zone radiation fields of the coaxial waveguide antenna with time harmonic excitation voltage. Complete characterization of the transient behavior is also found for (1) the fields interior to the feed line and (2) the radiated fields for excitation voltages arbitrary in their time dependence to the extent that kb,ka much less than one. This corresponds to the case of a thin antenna and excitation voltage with a non-zero rise time, specifically chosen so that frequencies violating the restriction kb,ka much less than one are negligible. (Modified author abstract) GRA

N74-19825# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DESIGNING ALGORITHMS FOR EXOATMOSPHERIC DISCRIMINATION
Bernard J. Burdick, George L. Carayannopoulos, William H. Schoendorf, and Charles W. Therrien 16 Jan. 1974 53 p refs
(Contract F19628-73-C-0002)
(AD-773834; TN-1974-4; ESD-TR-74-12) Avail: NTIS CSCL 17/9

The application of the concepts of feature extraction and statistical decision theory to exoatmospheric discrimination is described in the report with the emphasis on the philosophy of the design procedure rather than on specific techniques. The derivation of the discriminants and the decision rule for distinguishing between the radar or optical signatures of reentry vehicles and decoys is described along with procedures for evaluating the performance of the resultant discrimination algorithms.
Author (GRA)

N74-19826# Ohio State Univ., Columbus. ElectroScience Lab.
A POLARIZABILITY MATRIX REPRESENTATION OF ELECTRICALLY SMALL OBSTACLES
A. O. Yee and R. J. Garbacz Nov. 1973 28 p refs
(Grant AF-AFOSR-1710-69; AF Proj. 9769)
(AD-773810; ESL-2768-11; AFOSR-74-0113TR) Avail: NTIS CSCL 20/14

A polarizability matrix representation is developed to describe the interaction of a plane electromagnetic wave with a loss-free body of arbitrary shape and small electrical size. This matrix is used to express far scattered fields in terms of six induced dipole moments - three mutually orthogonal dipoles of electric type and three mutually orthogonal dipoles of magnetic type. The matrix elements are evaluated from scattering data obtained by an independent method, such as the method of moments. Some numerical results for a variety of wire structures are presented in graphical form and compared with results obtained by numerical solutions to the corresponding boundary value problems.
Author (GRA)

N74-20032 Laboratoire Central de l'Armement, Arcueil (France). Dept. Electronique.
PERFORMANCE OF DOPPLER RADAR [PERFORMANCES DES RADARS DOPPLER]
M. Trognon *In* Inst. Franco-Allemand de Rech. Meas. Methods in Ballistics 1973 p 47-59 In FRENCH (For availability see N74-20028 11-14)

N74-20033 Institut Franco-Allemand de Recherches, St. Louis (France).
TELEMETRIC Vo MEASUREMENTS [TELEMETRISCHE Vo-MESSUNGEN]
G. Schultze *In its* Meas. Method in Ballistics 1973 p 61-69 In GERMAN (For availability see N74-20028 11-14)

N74-20037 Institut Franco-Allemand de Recherches, St. Louis (France).
TELEMETRIC LASER METHOD FOR MEASUREMENT OF SMALL ANGULAR ERRORS [TELEMETRISCHES LASER-VERFAHREN ZUR MESSUNG KLEINER WINKELFEHLER]
B. Koch *In its* Meas. Methods in Ballistics 1973 p 161-173 In GERMAN (For availability see N74-20028 11-14)

N74-20042 Institut Franco-Allemand de Recherches, St. Louis (France).
TELEMETRIC MEASUREMENT OF IN-FLIGHT BALLISTIC DATA [TELEMETRISCHE MESSUNGEN BALLISTISCHER DATEN]
G. Schultze *In its* Meas. Methods in Ballistics 1973 p 243-257 In GERMAN (For availability see N74-20028 11-14)

N74-20045 Etablissement d'Experiences Techniques, Bourges (France).
LOCALIZATION OF IMPACTS [REPERAGE DES IMPACTS]
Delagarde *In* Inst. Franco-Allemand de Rech. Meas. Methods in Ballistics 1973 p 291-301 In FRENCH (For availability see N74-20028 11-14)

N74-20047 Institut Franco-Allemand de Recherches, St. Louis (France).
SPECIAL DEVELOPMENTS AND APPLICATIONS OF BALLISTIC TELEMETRY FOR TESTS OF NEW AERODYNAMIC BODIES [SPEZIELLE ENTWICKLUNGEN UND EINSATZMOEGLICHKEITEN DER BALLISTISCHEN TELEMETRIE BEI DER ERPROBUNG NEUER FLUGKOERPER]
G. Schultze *In its* Meas. Methods in Ballistics 1973 p 315-319 In GERMAN (For availability see N74-20028 11-14)

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

N74-19827*# Aerospace Corp., El Segundo, Calif. Systems Planning Div.
DORMAN COMPUTER PROGRAM (STUDY 2.5). VOLUME 1: EXECUTIVE SUMMARY Final Report
L. T. Stricker 15 Sep. 1973 16 p
(Contract NASw-2472)
(NASA-CR-137368; ATR-74(7335)-1-Vol-1) Avail: NTIS HC $4.00 CSCL 09B

The DORCA Applications study has been directed at development of a data bank management computer program identified as DORMAN. Because of the size of the DORCA data files and the manipulations required on that data to support analyses with the DORCA program, automated data techniques to replace time-consuming manual input generation are required. The Dynamic Operations Requirements and Cost Analysis (DORCA) program was developed for use by NASA in planning future space programs. Both programs are designed for implementation on the UNIVAC 1108 computing system. The purpose of this Executive Summary Report is to define for the NASA management the basic functions of the DORMAN program and its capabilities.
Author

N74-19828*# Aerospace Corp., El Segundo, Calif. Data Processing Subdivision.
DORMAN COMPUTER PROGRAM (STUDY 2.5). VOLUME 2: USER'S GUIDE AND PROGRAMMER'S GUIDE Final Report
Stanley T. Wray, Jr. 15 Sep. 1973 95 p
(Contract NASw-2472)
(NASA-CR-137367; ATR-74(7335)-1-Vol-2) Avail: NTIS HC $7.75 CSCL 09B

The DORMAN program was developed to create and modify a data bank containing data decks which serve as input to the DORCA Computer Program. Via a remote terminal a user can access the bank, extract any data deck, modify that deck, output the modified deck to be input to the DORCA program, and save the modified deck in the data bank. This computer program is an assist in the utilization of the DORCA program. The program is dimensionless and operates almost entirely in integer mode. The program was developed on the CDC 6400/7600 complex for implementation on a UNIVAC 1108 computer.
Author

N74-19829*# Aerospace Corp., El Segundo, Calif. Systems Planning Div.
DORMAN COMPUTER PROGRAM (STUDY 2.5). VOLUME 3: ORIGINAL DATA BANK LISTING Final Report
L. T. Stricker 15 Sep. 1973 77 p refs
(Contract NASw-2472)
(NASA-CR-137366; ATR-74(7335)-1-Vol-3) Avail: NTIS HC $7.00 CSCL 09B

A number of analyses have been performed using the DORCA program for several NASA-funded Aerospace Corporation studies in the past few years. The data decks containing the input data for these analyses have been compiled and are submitted, under separate cover. A few of the data decks are full (basic) decks containing every data item and are used as reference decks in the data bank. The other data decks were obtained by differencing a full deck with respect to one of the reference decks. Using the DORMAN program, a full deck can be recreated from the

modified deck and its reference deck when and if desired. The content and structure of the data bank are described. A description of each of these data decks is presented. Three of the cases that are included in this volume have become so widely recognized and accepted that additional descriptive material has been provided. The three cases are: Case 500 Costs, Case 506 Costs, and Case 403. Author

N74-19830*# Aerospace Corp., El Segundo, Calif.
DORMAN COMPUTER PROGRAM (STUDY 2.5). VOLUME 4: DORMAN PROGRAM LISTING, UNIVAC 1108 VERSION Final Report
Stanley T. Wray, Jr. 11 Sep. 1973 97 p
(Contract NASw-2472)
(NASA-CR-137358; ATR-74(7335)-1-Vol-4) Avail: NTIS HC $8.00 CSCL 09B

A listing is presented of the DORMAN program which was developed as a data bank management program for DORCA (Dynamic Operations Requirements and Cost Analysis) application. Author

N74-19831*# Code Research Corp., Anaheim, Calif.
SOFTWARE APPROACH TO AUTOMATIC PATCHING OF ANALOG COMPUTER Final Report
20 Nov. 1973 29 p
(Contract NAS8-28616)
(NASA-CR-120170) Avail: NTIS HC $4.50 CSCL 09B

The Automatic Patching Verification program (APV) is described which provides the hybrid computer programmer with a convenient method of performing a static check of the analog portion of his study. The static check insures that the program is patched as specified, and that the computing components being used are operating correctly. The APV language the programmer uses to specify his conditions and interconnections is similar to the FORTRAN language in syntax. The APV control program reads APV source program statements from an assigned input device. Each source program statement is processed immediately after it is read. A statement may select an analog console, set an analog mode, set a potentiometer or DAC, or read from the analog console and perform a test. Statements are read and processed sequentially. If an error condition is detected, an output occurs on an assigned output device. When an end statement is read, the test is terminated. Author

N74-19832*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
SUMC RECONFIGURABLE MICRO-ASSEMBLER Final Report
A. J. Edwards 17 Dec. 1973 26 p
(Contract NAS8-27202)
(NASA-CR-120178) Avail: NTIS HC $4.50 CSCL 09B

The development of a reconfigurable micro-assembler to provide the micro-programmer the capability to specify micro-instructions in concise, meaningful terms is discussed. The implementation plan for the development of the micro-assembler was predicted on the existing capabilities of the SUMC Reconfigurable Assembler. Utilizing the reconfigurable assembler as a base, new directives and existing directive modifications were implemented to provide the micro-assembly as a new capability of the reconfigurable assembler. The micro-assembler language allows the specification of all micro-instruction control field settings in one concise assembler source statement. The language appears very similar to a conventional machine instruction assembler language. The machine instruction assembler language has the characteristic of one operation specification per statement whereas, the micro-instruction assembler language allows multiple operations to be designated per statement. Author

N74-19833*# System Development Corp., Huntsville, Ala.
ANALYSIS OF REQUIREMENTS FOR COMPUTER CONTROL AND DATA PROCESSING EXPERIMENT SUBSYSTEMS: S-056 EXPERIMENT. IMAGE DATA PROCESSING SYSTEM SOFTWARE CALIBRATION AND APPLICATION SEQUENCE STUDY Final Report
20 Feb. 1974 23 p refs
(Contract NAS8-25471)
(NASA-CR-120177; TM-(L)-HU-033/009/00) Avail: NTIS HC $4.25 CSCL 09B

Software calibration data and an optimum sequence for image processing technique application are developed for use in processing of S-056 telescope images. Author

N74-19834*# Kanner (Leo) Associates, Redwood City, Calif.
MULTI ACCESS CONVERSATIONAL SYSTEM (MACS)
J. Karczewski Washington NASA Mar. 1974 14 p Transl. into ENGLISH from Polish PhD. Thesis, date unknown 10 p
(Contract NASw-2481)
(NASA-TT-F-15437) Avail: NTIS HC $4.00 CSCL 09B

A proposed monitor operating system is described for the ODRA 1204 computer, a Polish medium-capability computer which is not particularly suitable for time sharing due to its small memory. The OS takes into consideration the limitations in the hardware and the slow transfer rates and is designed to optimize the time allocated to each user in the central processor and to minimize the number of external memory transfers. Author

N74-19835*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NBODY - A MULTIPURPOSE TRAJECTORY OPTIMIZATION COMPUTER PROGRAM
William C. Strack Washington Feb. 1974 23 p refs
(NASA-TN-D-7543; E-6998) Avail: NTIS HC $3.00 CSCL 09B

Documentation of the NBODY trajectory optimization program is presented in the form of a mathematical development plus a user's manual. Optimal multistage-launch ascent trajectories may be determined by variational thrust steering during the upper phase. Optimal low-thrust interplanetary spacecraft trajectories may also be calculated with solar power or constant power, all-propulsion or embedded coast arcs, fixed or optimal thrust angles, and a variety of terminal end conditions. A hybrid iteration scheme solves the boundary-value problem, while either transversality conditions or a univariate search scheme optimize vehicle or trajectory parameters. Author

N74-19836*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE USE OF THE INNER ZONE ELECTRON MODEL AE-5 AND ASSOCIATED COMPUTER PROGRAMS
Michael J. Teague and James I. Vette Nov. 1972 75 p refs
(NASA-TM-X-69988; NSSDC-72-11) Avail: NTIS HC $6.75 CSCL 09B

A users guide to the inner radiation zone electron model AE-5 is introduced. The guide covers a description of the model, the forms in which it is available, directions on how to use the model, and a discussion of its limitations. Computer programs MODEL and ORP are described. These are major programs needed to use the electron models AE-4 and AE-5 and the smoothed proton models. Author

N74-19837*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE REAL-TIME ACQUISITION AND TRACKING PROGRAM FOR THE USNS VANGUARD
Robert F. Brammer Mar. 1974 20 p refs Submitted for publication
(NASA-TM-X-70615; X-816-74-55) Avail: NTIS HC $4.00 CSCL 09B

The computer program for the real-time acquisition and tracking program uses a variety of filtering algorithms including an extended Kalman filter to derive real-time orbit determination (position-velocity state vectors) from shipboard tracking and navigation data. Results from Apollo missions are given to show that orbital parameters can be estimated quickly and accurately using these methods. Author

N74-19838*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FUNCTION GENERATION SUBPROGRAMS FOR USE IN DIGITAL SIMULATIONS
Clint E. Hart [1974] 15 p
(NASA-TM-X-71526; E-7926) Avail: NTIS HC $4.00 CSCL 09B

Function generation subprograms were developed for handling

functions of one variable and two types of functions of two variables. These subprograms can be used in any digital or hybrid simulation requiring function generation. Use of these programs can often lower overall program execution time. Author

N74-19839*# Kanner (Leo) Associates, Redwood City, Calif.
SIGNAL HARMONIC ANALYSIS USING THE HP 2116 B COMPUTER
F. Palutan Washington NASA Apr. 1974 52 p refs Transl. into ENGLISH of "Sistema per l'Analisi Armonica dei Signali con Il Calcolatore HP 2116 B", Natl. Res. Council, Res. and Technol. Lab. for the Study of Plasma in Space, Rome, report LPS-72-17, Jul. 1972 74 p
(Contract NASw-2481)
(NASA-TT-F-15460; LPS-72-17) Avail: NTIS HC $5.75 CSCL 09B

Computer programs for real-time signal harmonic analysis as applied to the HP 2116 B computer are described. The BASIC language is used throughout. Topics discussed include sampling, quantization, discrete and fast Fourier transform algorithms, truncation, and amplitude spectrum recovery by Fourier transform of the autocorrelation function. The flow charts of the main program and subroutines are presented and technical details of the program outlined. Experimental results are detailed for the case of signals embedded in noise with various S/N ratios. The effects of aliasing and the use of Hanning windows are discussed. Author

N74-19840*# TRW Systems Group, Redondo Beach, Calif. Analysis and Experiment Support Section.
APOLLO PHOTOGRAPH EVALUATION (APE) PROGRAMMING MANUAL
I. J. Kim 22 Feb. 1974 108 p refs
(Contract NAS9-12330; Proj. Skylab)
(NASA-CR-134218; TRW-25990-H017-R0-00; TRW-74-FMT-935) Avail: NTIS HC $8.50 CSCL 09B

This document describes the programming techniques used to implement the equations of the Apollo Photograph Evaluation (APE) program on the UNIVAC 1108 computer and contains detailed descriptions of the program structure, a User's Guide section to provide the necessary information for proper operation of the program, and information for the assessment of the program's adaptability to future problems. Author

N74-19841# Naval Weapons Center, China Lake, Calif.
A FORTRAN OPTIMIZATION PROGRAM USING THE EPSILON METHOD
E. Y. Mikami Dec. 1973 32 p refs
(AD-771722; NWC-TP-5573) Avail: NTIS CSCL 12/1

A FORTRAN program is given for solving optimal control open-loop problems using the epsilon method. There is a mild growth restriction on the function in the state equation. The cost functional has to be of the form G(x(t sub f)), (t sub f)). An illustrative example is included. Author (GRA)

N74-19842# Washington Univ., St. Louis, Mo. Computer Systems Lab.
VIDEO PROCESSING HARDWARE FOR USE WITH AN IMAGE DISSECTOR CAMERA
Tim C. Perry May 1973 71 p refs
(Contracts ARPA SD-302; PHS-71-2289; Grant RR-00396; ARPA Order 655)
(AD-771749; TR-24) Avail: NTIS CSCL 09/2

The paper presents the design of video processing hardware to best use an image dissector camera in an image processing. Although most of the work was done with the idea of using the results on a specific dissector camera, much of it is applicable to a wide range of photo-multiplier devices. An analog integrator and digital timing circuit which measure the output current from an image dissector tube and produce constant signal-to-noise ratios of 10, 32, or 100 (selectable) are presented. A digital circuit which produces a number proportional to the log of the dissector current is also presented. Author (GRA)

N74-19843# Illinois Univ., Urbana.
[RESEARCH PROJECTS TO DEVELOP NUMERICAL TECHNIQUES FOR DATA PROCESSING AND LINEAR PROGRAMMING] Semiannual Technical Report, 1 Apr. - 30 Sep. 1973
D. L. Slotnick 1 Nov. 1973 21 p refs
(Contract DAHC04-72-C-0001; ARPA Order 1899)
(AD-772511; CAC-93) Avail: NTIS CSCL 09/2

During this period there was research in the following areas: Development of numerical techniques suitable for parallel processing in the areas of linear programming, algebraic eigenvalue, and approximation of functions; ILLIAC 4 multispectral image processing; enhancements to the PEESPOL compiler; network terminal systems project; and, distributed computational systems of heterogeneous computers. GRA

N74-19844# Stanford Research Inst., Menlo Park, Calif.
DEVELOPMENT OF NEW PATTERN-RECOGNITION METHODS Final Report, 1 Jul. 1971 - 19 Jan. 1973
D. J. Hall, R. O. Duda, D. A. Huffman, and D. E. Wolf Wright-Patterson AFB, Ohio ARL Nov. 1973 232 p refs
(Contract F33615-71-C-1894; AF Proj. 7071)
(AD-772614; ARL-73-0153) Avail: NTIS CSCL 09/2

Methods in pattern recognition are studied in relation to classical approaches using techniques of multivariate statistical analysis. The application of these techniques to specific problems in physical, engineering, behavioral, and other sciences is reviewed. Problems of improved data description and dimensionality reduction are tackled by means of clustering approaches. Several improved clustering methods are developed for general pattern recognition: an approximate procedure for computing the minimal-spanning tree, application of the Kolmogorov-Smirnov test for cluster validity, an application of relativistic principles in measures of relationship. Experiments using interactive graphic displays to illustrate these methods are described, and application of computer programs to meteorological problems is demonstrated. (Modified author abstract) GRA

N74-19845# National Research Council of Canada, Ottawa (Ontario).
AN ECONOMICAL HIGH SPEED DATA ACQUISITION AND PROCESSING SYSTEM FOR WIND TUNNEL EXPERIMENTS
E. S. Hanff 1973 6 p refs
(AD-773159) Avail: NTIS CSCL 14/2

A high speed off-line data acquisition and processing system has been developed, specifically designed for intermittent wind tunnel applications including stability derivative measurements. The versatility of the system, however, permits its use in a variety of data acquisition situations. The low cost, computing capability, speed and simplicity of operation make this system particularly attractive for the acquisition and reduction of data at smaller intermittent facilities. GRA

N74-19846# California Univ., Los Angeles. Dept. of System Sciences.
DATA COMPRESSION OF POISSON PROCESSES
Izhak Rubin Nov. 1973 49 p refs
(Contract N00014-69-A-0200-4041)
(AD-772565; UCLA-ENG-7392) Avail: NTIS CSCL 09/4

In the paper, the author derives rate-distortion functions, under proper magnitude-error fidelity criteria, and studies instrumentable data-compression schemes for Poisson processes. In particular, the author derives information rates and obtains rate-distortion relationships for practical data-compression schemes, for the reproduction of the unordered sequency of Poisson event occurrences, for the reproduction of the sample functions of the Poisson counting process, and for the reproduction of the sequence of intervals between the event occurrences of a Poisson process. The reproducing processes are taken to be point (or jump) processes themselves. The performances of the various data-compression schemes presented here are compared with those of the ideal schemes (as presented by the rate-distortion functions), and are shown to be close to the latter over wide regions of distortion. (Modified author abstract) GRA

N74-19847# Electronic Systems Div., L. G. Hanscom Field, Mass.
THE FORTRAN FREQUENCY ANALYZER
Sep. 1973 22 p
(AD-772646; ESD-TR-73-291) Avail: NTIS CSCL 09/2

The report introduces the FORTRAN Frequency Analyzer

program and describes the Analyzer's implementation, uses, and output. An illustrative example is presented which has been specifically designed for simplicity to allow the programmer/analyst to validate the Analyzer's output. To date, the Analyzer has been successfully executed by ESD on an IBM 360/50, 360/65, and 370/155. The Job Control Language necessary for implementation and execution on an IBM 370/155 is presented. Author (GRA)

N74-19848# Naval Ordnance Lab., White Oak, Md.
PROGRESS TOWARD THE CROSSTIE MEMORY
Leonard J. Schwee, Henry R. Irons, Albert D. Krall, Wallace E. Anderson, and J. Kenneth Watson 1 Oct. 1973 60 p refs
(AD-772485; NOLTR-73-185) Avail: NTIS CSCL 09/6

Progress toward a magnetic serial access memory which stores information in domain walls of a magnetic thin film is reported. Called the crosstie memory, it represents a radical departure from previous techniques in which the information is stored in domains rather than walls. The crosstie memory is intended for use as a block oriented random access memory (BORAM) or fast auxiliary memory (FAM). The advantages of the crosstie approach are speed, low power, high bit density, nonvolatility, a wide temperature operating range, low cost, and available technology. The report summarizes the background knowledge necessary for the design of such a memory. This includes experiments on stability conditions, mobility, dynamic effects, propagation, and detection. The crosstie method appears completely feasible and several options are possible for its ultimate embodiment. Author (GRA)

N74-19849# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
USE OF THE THEORY OF DISCRETE AUTOMATA FOR THE ANALYSIS OF MULTIPLICATION METHODS IN A DIGITAL COMPUTER WITH THE USE OF ADDITIONAL SHIFT CIRCUITS
E. N. Varilov and S. G. Chobanov 11 Dec. 1973 16 p refs
Transl. into ENGLISH from Kibernetika (USSR), no. 3, 1971
(AD-772648; FTD-HT-23-315-74) Avail: NTIS CSCL 09/2

Formulas are presented to calculate the average number of shifts for a multiplier bit depending on the bit configuration of a digital computer. GRA

N74-19850# Hawaii Univ., Honolulu.
THE ALOHA SYSTEM Final Report
Franklin F. Kuo Dec. 1973 15 p refs
(Contract F44620-69-C-0030; AF Proj. 9769)
(AD-773327; AFOSR-74-0019TR) Avail: NTIS CSCL 09/2

The research program covered all aspects (theory, systems design, hardware and software) of the ALOHA system computer communications network. The ALOHA network is the first operational computer net to use radio rather than hardwire communications. The network, in operation since mid-1971, employs packet switching techniques similar to those of the ARPANET in conjunction with a random access broadcasting technique which can multiplex large numbers of remote users on a single radio channel. The major technical accomplishments which can be clearly identified in the development of the ALOHA system are discussed. GRA

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N74-19851 British Broadcasting Corp., Kingswood (England). Research Dept.
A UHF VERTICALLY-POLARISED RECEIVING AERIAL FOR RE-BROADCAST LINKS
G. H. Millard and J. L. Riley Feb. 1974 11 p refs
(BBC-RD-1974/8) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

A vertically-polarised receiving aerial for use in rebroadcast links is reported. The aerial is designed to be highly directional in the horizontal plane and to have low side and back lobes. Three versions of the aerial are required to cover the UHF television frequency bands. Author

N74-19852*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PIEZOELECTRIC RELAY Patent Application
Donald H. Fryklund, inventor (to NASA) (Accumetrics Corp.) Filed 12 Mar. 1974 22 p Sponsored by NASA
(NASA-Case-GSC-11627-1; US-Patent-Appl-SN-450501) Avail: NTIS HC $4.25 CSCL 09A

A piezoelectric device, particularly adapted for use as an electrostatic relay, is described. Each bimorph includes a stacked arrangement of piezoelectric plates and electrodes. First ends of the bimorphs of each bimorph pair are rigidily connected. The pairs of bimorphs are mounted so that all of them lie in parallel planes and have aligned longitudinal axes. The bimorph pairs are electrically connected so that the bimorphs of the two pairs are oppositely polarized and deflect in opposite direction relative to the fixed support. NASA

N74-19853*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CONTROLLABLE HIGH VOLTAGE SOURCE HAVING FAST SETTLING TIME Patent Application
Henry Doong and Mario H. Acuna, inventors (to NASA) Filed 19 Mar. 1974 15 p
(NASA-Case-GSC-11844-1; US-Patent-Appl-SN-452761) Avail: NTIS HC $4.00 CSCL 09E

A high voltage dc stepping power supply for sampling a utilization device such as an electrostatic analyzer has a relatively fast settling time. The supply includes a waveform generator for deriving a low voltage staircase waveform that feeds a relatively long response time power supply. In the power supply, an ac voltage modulated by the staircase waveform is applied to a step-up transformer and thence to a voltage multiplier stack to form a high voltage. A constant dc source, applied to the input of the power supply, biases the voltage at the intermediate output terminal to be in excess of the predetermined multiple of the input voltage. A fast shunt regulator responsive to the input signal provides an output. NASA

N74-19854*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
RESONANT WAVEGUIDE STARK CELL Patent Application
Wesley C. Easley, William F. White, and George A. Wingfield, inventors (to NASA) Filed 10 Apr. 1974 10 p
(NASA-Case-LAR-11352-1; US-Patent-Appl-SN-459736) Avail: NTIS HC $4.00 CSCL 09E

A resonant waveguide Stark cell is described suitable for use in a Stark-modulated microwave spectrometer. The cell is constructed from a short length of waveguide. A Stark electrode is located inside the waveguide parallel to the broad face of the guide and insulated with narrow teflon strips. A reflector with a small coupling iris at its center is located at one end of the cell. This small coupling iris is for passing microwave energy into and out of the cell. At the other end of the cell there is an adjustable waveguide short making the small Stark cell into a tunable cavity. Means are provided for maintaining a gas-tight compartment within the cell, and ports are provided for the introduction of the gas. NASA

N74-19855# Stanford Research Inst., Menlo Park, Calif.
DESIGN TABLES FOR RF MATCHING NETWORKS Final Report
Ulrich H. Gysel Aug. 1973 28 p refs
(Contract DAAB07-73-C-0145; SRI Proj. 2575)
(AD-772691) Avail: NTIS CSCL 09/5

The report describes the design of two matching networks for use with an electron-beam semiconductor (EBS). Tables for matching networks for two different constraint loads were done. Computer optimization techniques were used in generating those tables, and results were obtained that are equal-ripple for any practical purposes. The table values are quite smoothly varying functions of the triode-grid and EBS-diode parameters, which should permit interpolation for intermediate values of these parameters. Trial networks were built for both types of load.

Measured parameters for the experimental models were compared with calculated values that correspond to the actual network portion built. GRA

N74-19856# General Electric Co., Syracuse, N.Y. Heavy Military Electronic Systems.
NANOSECOND PULSE ANTENNA NARHORN Final Report, 15 Dec. 1969 - 1 Jul. 1973
Robert D. Wengenroth, Maurice C. Swanson, Byron A. Tietjen, Alan E. Blume, and Wayne S. Kenyon Oct. 1973 139 p refs
(Contract F30602-70-C-0073; AF Proj. 4506)
(AD-773184; RADC-TR-73-308) Avail: NTIS CSCL 09/5

The report discusses the design and fabrication of a folded cone type antenna for the Nanosecond Radar Laboratory of the Rome Air Development Command. The radiofrequency performance was determined by computation and model measurement. Gain is over 39 db with beamwidths about 1.5 degrees in the E-plane and 1.9 degrees in the H-plane. The first E-plane sidelobes with the government furnished horn input transition may be about -12 db. With a low mode-conversion transition, the first E-plane sidelobes would be -16 db or better, and the first H-plane sidelobes -20 db or better. The shielded nature of the antenna provides distant sidelobes mostly below the isotropic gain level. The mechanical construction is of aluminum sheet on an aluminum support structure. The elevation drive is geared and the azimuth drive is accomplished through wheels in an unusual tripod structure. The antenna presents an aerodynamically unbalanced load. The control system follows binary command signals or manual motion controls. (Modified author abstract) GRA

N74-19857# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
FEASIBILITY OF SILICON CARBIDE HIGH FREQUENCY, HIGH POWER DEVICES Final Report, Oct. 1972 - Jun. 1973
S.-Y. Wu, Robert B. Campbell, and Herbert S. Berman Jul. 1973 38 p refs
(Contract F19638-73-C-0072; AF Proj. 5620)
(AD-772642; WANL-TME-2842; AFCRL-TR-73-0505) Avail: NTIS CSCL 09/1

Several material parameters of SiC were examined and figures of merit calculated to show the potential of SiC as a high frequency, high power device material. Schottky barrier diodes were prepared on n-type SiC by sputtering on a gold layer. The barrier voltage, measured by three techniques, was found to be 1.40 plus or minus 0.05 eV. An initial study was made on ion implanted layers (N2 into p-type SiC) but usuable diodes were not obtained. Author (GRA)

N74-19858# Naval Civil Engineering Lab., Port Hueneme, Calif.
PRACTICAL APPLICATION AND EFFECTIVENESS OF COMMERCIALLY AVAILABLE PULSE VOLTAGE TRANSIENT SUPPRESSORS
M. N. Smith Dec. 1973 66 p
(YF53534005)
(AD-773074; NCEL-TN-1312) Avail: NTIS CSCL 09/1

Most utility power distribution systems at one time or another have random and periodic impulse voltage transients propagated throughout the system. In many cases these transients cause malfunction and physical damage to critical loads. It is possible to reduce the peak voltage levels of many types of transients to a level that most critical loads can tolerate. The report covers the results of test and evaluation of five types of commercially available impulse voltage transient suppressors. It was concluded that no one type suppressor tested meets all the requirements to completely protect critical loads, but some do effectively meet some of these requirements on a cost effective basis. Author (GRA)

N74-19859# Harvard Univ., Cambridge, Mass. Cruft Lab.
AN EXPERIMENTAL INVESTIGATION OF THE IMPEDANCE OF CAVITY-BACKED SLOT ANTENNAS Final Report, 1 Nov. 1972 - 30 Jun. 1973
Stuart A. Long Jun. 1973 168 p refs
(Contract F19628-73-C-0084; AF Proj. 5635)
(AD-772644; AFCRL-TR-73-0492) Avail: NTIS CSCL 09/5

The impedance of a simple open slot antenna was measured as a function of frequency and followed by a careful experimental study of the impedance of the same slot with several different cavity-backings. The impedance was found both as a function of frequency and the various parameters of the cavity. Author (GRA)

N74-19860# National Bureau of Standards, Washington, D.C.
HIGH TEMPERATURE ELECTRICAL CONDUCTIVITY MEASUREMENT TECHNIQUES Final Report, 27 Apr. 1971 - 26 Apr. 1972
H. P. R. Frederikse and W. R. Hosler Nov. 1973 32 p refs
(Contract F33615-71-M-5008; AF Proj. 7021)
(AD-772776; ARL-73-0156) Avail: NTIS CSCL 20/12

The report deals with experiments aimed at a critical evaluation of electrical conductivity measurements on semiconducting and semi-insulating materials above 1500C. An initial study was made of the differential thermionic emission between two Pt-electrodes as a function of applied voltage, temperature and gas environment (Double-diode). Subsequent experiments on alumina and sapphire used a novel geometry, eliminating surface and gas conduction. Current densities in the range 1400-1650C appeared to be of the same order of magnitude as those observed between two Pt-electrodes in vacuum. The suggestion is made that the current through the oxide is determined by the difference between the thermionic emissions from the electrodes into the sample under small applied voltage. Author (GRA)

N74-19861# Army Electronics Command, Fort Monmouth, N.J.
CONDUCTION CHANGES IN GUNN DEVICES UNDER THE INFLUENCE OF 10.6 AND 0.6328 MICROMETER FLUXES
W. B. Glendinning, K. H. Fischer, H. Jacobs, and M. Benanti Dec. 1973 32 p
(DA Proj. 1S6-62705-A-440)
(AD-772905; ECOM-4170) Avail: NTIS CSCL 09/1

The room temperature response (conductance) of GaAs material in a Gunn device structure under the influence of 10.6 micrometers and 0.6328 micrometer irradiation was investigated. Both continuous wave and pulsed irradiations were used in making measurements on devices placed in dc and 60 Hz dynamic test circuits. Negative and positive conductance changes were determined from the CO2 and HeNe fluxes, respectively. The responsivity of the Gunn device under CO2 irradiation was calculated to be 0.023 A/W. Negative conductance change was attributed to thermal heating whereas the positive change was interpreted as resulting from carrier generation (photoconductive effect). Author (GRA)

N74-19862# Texas Instruments, Inc., Dallas.
INVESTIGATION OF SEMICONDUCTOR CHARGE DEVICES, PART 1 Final Report
D. D. Buss, J. D. Holmes, and L. A. Rosser Oct. 1973 167 p refs
(Contract F30602-73-C-0027)
(AD-772637; RADC-TR-73-259-Pt-1) Avail: NTIS CSCL 09/1

The analyses presented in this report apply equally to charge coupled devices (CCDs) and bucket brigade devices (BBDs), the two categories of CTDs. Both CCDs and BBDs are examined and compared with competing technologies. The primary emphasis in this program was placed on the potential of these devices for low data rate, spread-spectrum, matched filtering. However, in addition, consideration was also given to other applications such as low-pass and band-pass filtering, analog delay, telephone line equalization, and single sideband modulation. Theoretical analysis is given of limitations, behavior, and tradeoffs among CTD parameters of interest, and noteworthy general characteristics of the technology are discussed. (Modified author abstract) GRA

N74-19863# Texas Instruments, Inc., Dallas.
INVESTIGATION OF SEMICONDUCTOR CHARGE DEVICES, PART 2 Final Report
D. D. Buss and W. H. Bailey Oct. 1973 123 p refs
(Contract F30602-73-C-0027)
(AD-772638; RADC-TR-73-259-Pt-2) Avail: NTIS CSCL 09/1

The report details the design, fabrication, and testing of the breadboard model of a binary spread-spectrum receiver. The objective of this portion of the program was to prove out the theoretical analysis reported in Part I of this Final Report.
Author (GRA)

N74-19864# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF SEMICONDUCTOR DEVICES IN LINEAR ELECTRON ACCELERATORS
R. A. Mamedov, N. A. Ukhin, V. M. Ryazanskii, and K. B. Vasilev 18 Dec. 1973 10 p Transl. into ENGLISH from Radiatsionnaya Fizika Nemetallicheskikh Kristallov (USSR), v. 3, no. 2, 1971 p 200-205
(AD-773504; FTD-HT-23-94-74) Avail: NTIS CSCL 09/1

The article discusses ionization processes in semiconductor devices as a function of the intensity of pulsed irradiation in the range from 10 to the 7th power rad/s to 5 x 10 to the 10th power rad/s. GRA

N74-19865# California Univ., Livermore. Lawrence Livermore Lab.
WAMP: A USERS MANUAL FOR THE WIRE ANTENNA MODELING PROGRAM Final Report
Fred J. Deadrick and Edmund K. Miller 10 Dec. 1973 110 p refs
(AD-773769; UCID-30084) Avail: NTIS CSCL 09/1

Program WAMP is a Wire Antenna Modeling Program written in FORTRAN IV and applicable to arbitrary antenna and support structures. WAMP models an antenna as a series of interconnected straight wire segments, and solves the electromagnetic boundary value problems by numerically evaluating an electric field integral equation. Antennas may be analyzed in free space, over a perfect ground, a radial ground screen or in the presence of any homogeneous media. Antenna input impedance, current distributions, near-electric fields and far-field radiation patterns are also calculated. The users' manual covers both the theory and numerical techniques employed in WAMP. The program's input variables are defined, and illustrative examples are used to demonstrate the program's capabilities. Author (GRA)

N74-19866# California Inst. of Tech., Pasadena. Antenna Lab.
SHIELDING THEORY OF ENCLOSURES WITH APERTURES Ph.D. Thesis
Horacio Augusto Mendez 4 Dec. 1973 143 p refs
(Grant AF-AFOSR-1935-70; AF Proj. 9768)
(AD-773770; AFOSR-74-0100TR; TR-68) Avail: NTIS CSCL 09/1

Present methods for computing the shielding efficiency of metallic plates with apertures are based on the analysis of a plane wave incident on an infinite conducting sheet. When applied to actual enclosures with internal radiation sources, these methods lose all validity, and obviously fail to predict the measured results. This dissertation develops the theory of electromagnetic radiation from metallic enclosures with apertures, excited by an internal source at frequencies below the fundamental resonance of the enclosure. The enclosure with an aperture is analyzed from two different points of view: as a cavity with a small aperture in a wall; and as a waveguide section short-circuited at one end and open at the other end. (Modified author abstract) GRA

N74-19867# Raytheon Co., Waltham, Mass. Research Div.
FERRITES FOR LOW-COST PHASE SHIFTERS Final Technical Report, 1 May 1971 - 31 Aug. 1973
H. J. VanHook and J. J. Green Jan. 1974 102 p refs
(Contract DAAB07-71-C-0174; DA Proj. 1T7-62705-A-348)
(AD-773661; S-1624; ECOM-0174-F) Avail: NTIS CSCL 09/5

Two objectives have been defined for the performance of this contract. The first is the development of a low-magnetic-loss, temperature-stable polycrystalline garnet for an above-resonance microwave UHF circulator application: A Ca-V-In garnet was developed. The nominal composition is Y(1.70)Ca(1.30)V(.65)In(.35)Fe4O12. A second objective was the development of an S-band phase shifter material which would offer some improvement in temperature stability and lower materials cost over presently available ferrites. These garnets are characterized by good temperature stability a low magnetic loss, and low materials cost due to the absence of expensive yttrium and rare-earth chemicals. (Modified author abstract) GRA

N74-19868# Pennsylvania State Univ., University Park. Materials Research Lab.
CONTACTS BETWEEN CHALCOGENIDE GLASSES, METALS AND SEMICONDUCTORS Final Report, 1 Jun. 1970 - 31 May 1973
H. K. Henisch 1 Feb. 1974 16 p refs
(Contract DAHC04-70-C-0047; ARPA Order 15)
(AD-773866) Avail: NTIS CSCL 09/1

The main purposes of the research were the elucidation of switching mechanisms and the exploration of systems with contact materials which can be electronically altered in situ. GRA

N74-19869# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROPERTIES OF TRANSISTORS DURING CONTINUOUS OPERATION AND STORAGE
N. N. Goryunov 17 Jan. 1974 138 p refs Transl. into ENGLISH from Biblioteka po Radioelektronike. Suoystva Poluprov. Priborov pri Dlitel'noy Rabote i Khranenii (USSR), no. 23, 1970 p 1-103
(AD-773880; FTD-MT-24-235-74) Avail: NTIS CSCL 09/1

The report discusses properties of semiconductor diodes and transistors during their continuous operation and storage. Descriptions are given of basic reasons for the failures of instruments connected with phenomena on the surface of crystals, the breakdown of junctions, and the destruction of contacts. Mathematical models of the processes of failures are given. Technical specifications are stated for the quality and reliability of instruments, the methods of checking them, and test evaluation. Information is given about accelerated tests and indestructible quality control. The experimental dependences of the failure rate and change in parameter values of instruments on time and load are given. Recommendations are given regarding the design of reliable equipment on diodes and transistors. GRA

N74-19799* Hughes Aircraft Co., El Segundo, Calif. Space and Communications Group.
TASK THREE: REPORT: STDN ANTENNA AND PREAMPLIFIER COST TRADEOFF STUDY
In its Technology Forecasting for Space Communication Jun. 1973 124 p refs (For availability see N74-19796 11-07)
(SCG-30195R) CSCL 09A

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

N74-19870* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MICROWAVE POWER TRANSMISSION SYSTEM WHEREIN LEVEL OF TRANSMITTED POWER IS CONTROLLED BY REFLECTIONS FROM RECEIVER Patent
William J. Robinson, Jr., inventor (to NASA) Issued 5 Mar. 1974 5 p Filed 13 Mar. 1973 Supersedes N73-20257 (11 - 11, p 1264)
(NASA-Case-MFS-21470-1; US-Patent-3,795,910;
US-Patent-Appl-SN-340871; US-Patent-Class-343-7.5;
US-Patent-Class-325-62; US-Patent-Class-333-17;
US-Patent-Class-343-17.7) Avail: US Patent Office CSCL 09C

A microwave, wireless, power transmission system is described in which the transmitted power level is adjusted to correspond with power required at a remote receiving station. Deviations in power load produce an antenna impedance mismatch causing variations in energy reflected by the power receiving antenna employed by the receiving station. The variations in reflected energy are sensed by a receiving antenna at the transmitting station and used to control the output power of a power transmitter. Official Gazette of the U.S. Patent Office

N74-19871# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON EASTERN EUROPE SCIENTIFIC AFFAIRS, NO. 393
6 Mar. 1974 152 p refs Transl. into ENGLISH from Arch. Automat. Telemech. (Warsaw), v. 18, no. 2, 1973 p 135-249 (JPRS-61413) Avail: NTIS HC $10.75

Articles concerning the development of and progress in various theoretical and applied scientific disciplines and technical fields of East European scientific organizations are presented. The subjects discussed are: (1) theory and practice of automatic control, (2) theory of control and optimization, (3) control in large scale systems, (4) mathematical models and identification of processes, and (5) theory of digital automata. For individual titles, see N74-19872 through N74-19878.

N74-19872 Joint Publications Research Service, Arlington, Va.
THE THEORY AND PRACTICE OF AUTOMATIC CONTROL
Antoni Niederlinski *In its* Transl. on Eastern Europe Sci. Affairs, No. 393 (JPRS-61413) 6 Mar. 1974 p 1-25 refs Transl. into ENGLISH from Arch. Automat. Telemech. (Warsaw), v. 18, no. 2, 1973 p 135-152 (For availability see N74-19871 11-10)

An historical account of the theory and practice of control is presented. The activities of organizations and individuals in the field of control theory from 1800 to the present are briefly outlined. The subject of control theory is presented under the following headings: (1) theory of linear control systems, (2) methods for analyzing nonlinear control systems, (3) impulse and digital control systems, (4) extreme control systems, (5) relay control systems, and (6) multidimensional control systems. Author

N74-19873 Joint Publications Research Service, Arlington, Va.
THE THEORY OF CONTROL AND OPTIMIZATION
Henryk Gorecki *In its* Transl. on Eastern Europe Sci. Affairs, No. 393 (JPRS-61413) 6 Mar. 1974 p 26-54 refs Transl. into ENGLISH from Arch. Automat. Telemech. (Warsaw), v. 18 no. 2, 1973 p 153-173 (For availability see N74-19871 11-10)

The application of control theory for investigating the transfer of signals through dynamic and technical systems is discussed. The expansion of control theory to biological and economic systems is explained. The three trends which can be discerned in the development of control theory are identified as: (1) refining and applying new concepts, theorems, and methods, (2) expanding the findings of theory to more general mathematical models, and (3) applying the methods and models to the solution of practical problems. Research projects in control theory are reported and the results are analyzed. Author

N74-19874 Joint Publications Research Service, Arlington, Va.
CONTROL IN LARGE-SCALE SYSTEMS
Kazimierz Manczak *In its* Transl. on Eastern Europe Sci. Affairs, No. 393 (JPRS-61413) 6 Mar. 1974 p 55-73 refs Transl. into ENGLISH from Arch. Automat. Telemech. (Warsaw), v. 18, no. 2, 1973 p 175-188 (For availability see N74-19871 11-10)

The concept of large-scale systems is developed independently of automation and cybernetics, and is used in numerous fields. Large-scale systems include economic systems, information networks, bionic systems, production enterprises, etc. The concept thus has very general significance. A number of definitions of large-scale systems exist. Following Goode and Machol's classical definition, the most characteristic features of a large-scale system are: (1) the existence of a general goal of endeavor, (2) a large number of dimensions, in terms of the number of inputs, outputs, subsystems, functions accomplished, or costs; (3) complexity of maintenance, (4) high degree of organization, (5) incomplete initial information, and (6) the existence of contradictory goals among the subsystems. Author

N74-19875 Joint Publications Research Service, Arlington, Va.
MATHEMATICAL MODELS AND IDENTIFICATION OF PROCESSES
Zdzislaw Bubnicki *In its* Transl. on Eastern Europe Sci. Affairs, No. 393 (JPRS-61413) 6 Mar. 1974 p 74-86 refs Transl. into ENGLISH from Arch. Automat. Telemech. (Warsaw), v. 18, no. 2, 1973 p 189-198 (For availability see N74-19871 11-10)

The terms mathematical model and identification are defined in the context of their association with control theory and practice. It is stated that the need for mathematical models is unavoidable in the transition from heuristic methods of planning and control to analytic methods and algorithmic procedures. It is particularly in the algorithmization of control that detail is required for specifying a mathematical model of the process being controlled. The application of methods of systems analysis to the planning and control of economic, sociological, service, ecological, and biological systems is discussed. Author

N74-19876 Joint Publications Research Service, Arlington, Va.
THE THEORY OF DIGITAL AUTOMATA
Wieslaw Traczyk *In its* Transl. on Eastern Europe Sci. Affairs (JPRS-61413) 6 Mar. 1974 p 87-101 refs Transl. into ENGLISH from Arch. Automat. Telemech. (Warsaw), v. 18, no. 2, 1973 p 199-208 (For availability see N74-19871 11-10)

The term automata theory is analyzed to show a wide range of quite different problems. It includes the abstract theory of very generally understood devices for processing discrete information together with the problems of their interaction and of their behavior in the environment. This group of problems also includes the theory of stochastic automata, automata games, applied automata, Turing machines, Post machines, and others, along with the associated linguistic problems. The results achieved in this field have so far found rather little direct practical application, but are applied indirectly, by inspiring new directions for practical investigations. Other branches of automata theory, which are closer to engineering problems, are often embraced under the terms theory of digital systems, theory of digital automata, or theory of switching systems. It includes the analysis and synthesis of practical digital systems, with various structures, applying various elements, and with various criteria for optimum performance. Author

N74-19877 Joint Publications Research Service, Arlington, Va.
REMOTE CONTROL SYSTEMS
Antoni Pach *In its* Transl. on Eastern Europe Sci. Affairs, No. 393 (JPRS-61413) 6 Mar. 1974 p 102-122 refs Transl. into ENGLISH from Arch. Automat. Telemech. (Warsaw), v. 18, no. 2, 1973 p 209-225 (For availability see N74-19871 11-10)

Systems of telemechanics or remote control systems are discussed. Depending on the type of information transmitted, telemechanics is divided into: (1) telemanagement (remote management), (2) telemetry (remote measurement), (3) telecontrol (remote control or remote signalling), and (4) teleregulation (remote regulation). The development and application of telemechanical systems in the electric power industry, the gas industry, and the railroad system are reported. Author

N74-19878 Joint Publications Research Service, Arlington, Va.
POLISH EDUCATION IN THE FIELD OF AUTOMATION SCIENCE c34
Henryk J. Leskiewicz *In its* Transl. on Eastern Europe Sci. Affairs, No. 393 (JPRS-61413) 6 Mar. 1974 p 123-150 Transl. into ENGLISH from Arch. Automat. Telemech. (Warsaw), v. 18, no. 2, 1973 p 227-249 (For availability see N74-19871 11-10)

The technical revolution brought about by automation of productive processes is gradually reaching every country. Any acceleration in the transition to the new techniques which this revolution implies, sooner or later has a positive effect. The tasks of the educational system in accelerating this revolution can be summarized as: (1) popularization of automation science; (2) on-the-job training of mid-level technical personnel to master the field of automation science; (3) introducing all higher-level technical personnel in all specialties to the problems of automation science and the opportunities offered by its introduction; (4) training various types of specialists in automation science at the higher levels of education; (5) doctoral-level training of automation scientists, and (6) stimulating habilitation studies in this field. Author

N74-19879# Nagoya Univ. (Japan). Inst. of Plasma Physics.
A MULTICHANNEL STORAGE CAPACITOR SYSTEM FOR PROCESSING OF FAST SIMULTANEOUS SIGNALS
Atsushi Ogata Oct. 1973 15 p refs
(IPPJ-T-16) Avail: NTIS HC $4.00

A storage capacitor system is described which collects simultaneous signals in a very short sampling time, stores them

in capacitors and gives them as an output slowly in a serial form. Author

N74-19880# Centre National de la Recherche Scientifique, Strasbourg (France). Lab. de Physique du Noyay et de Physique des Particules.
SCRO-BRANCH: AMPLIFIERS AND MEMORIES FOR MULTIWIRE PROPORTIONAL CHAMBERS
Guy Schultz and Yves Chatelus Feb. 1973 28 p refs In FRENCH
(FRNC-R-27; Note-CAMAC-16-01) Avail: AEC Depository Libraries HC $3.50

Hybrid circuits were developed enabling a signal from a proportional chamber to be amplified and memorized. In order to memorize only events fulfilling certain fast triggering criteria of an experiment, the amplifier and memory circuit are housed in the same casing, a monostable circuit delaying the pulse at the amplifier output before its memorization. The high level of parasitic noise (two streamer chambers) near to the proportional chambers add to the necessity of reducing the dead time and to separating the amplifier from the memory circuits. A linking cable (twisted pair of wires) producing a delay of 188 ns (measured with a reflectometer) is introduced. In this way the electronic delays are compensated without the introduction of a dead time. NSA

N74-19881# Sandia Labs., Albuquerque, N.Mex.
CERAMIC SUBSTRATES FOR HYBRID MICROCIRCUIT APPLICATIONS
R. E. Knutson Sep. 1973 85 p refs
(Contract AT(29-1)-789)
(SLA-73-886) Avail: NTIS HC $6.25

The various investigations undertaken and the test procedures developed to evaluate high-density unglazed alumina substrates for use in thin-film hybrid microcircuit applications are summarized. In addition to obtaining an increased understanding of substrate material, this project culminated in the publication of an official material specification. A fairly detailed explanation of certain aspects of the specification is also included. Author (NSA)

N74-19882# Commissariat a l'Energie Atomique, Grenoble (France). Lab. d'Electronique et de Technologie de l'Informatique.
USE OF SILICON STRUCTURES ON INSULATORS TO MAKE INTEGRATED MOS CIRCUITS
J. Borel, J. P. Suat, J. Bernard, and M. Garcia 13 Feb. 1973 33 p refs In FRENCH Presented at the Meeting on SEE Studies on Recent Progress in MOS Technol., Malakoff, France, 24 Jan. 1973
(CEA-Conf-2359; Conf-730132-2) Avail: AEC Depository Libraries HC $3.75

The use of silicon structures on insulators to reduce interference current capacities and improve certain other properties of integrated MOS circuits is investigated. Principle results and performance data are included. Transl. By E.H.W.

N74-19883# California Univ., Berkeley. Operations Research Center.
OPTIMAL CONTROL THEORY WITH TIME DELAY
William B. Arthur Nov. 1973 84 p refs
(Contract DA-31-124-ARO(D)-331; Grant NSF GP-30961)
(AD-772543; ORC-73-27) Avail: NTIS CSCL 12/1

The report deals with the discrete optimal control problem with time delay. Unlike the usual control problem, the time-delay problem has dynamics and possibly also objective criterion as functions of past states and past control actions. Throughout the thesis, dynamic programming is used as the basic tool of optimization. GRA

N74-19884# California Univ., Los Angeles. Dept. of System Sciences.
PATH DELAYS IN COMMUNICATION NETWORKS
Izhak Rubin Nov. 1973 57 p refs
(Contract N00014-69-A-0200-4041)
(AD-772567; UCLA-ENG-7393) Avail: NTIS CSCL 17/2

A communication network is modelled by a weighted graph. The vertices of the graph represent stations with storage capabilities, while the edges of the graph represent communication channels (or other information processing media). Channel capacity weights are assigned to the edges of the network. The network is assumed to operate in a store-and-forward manner, so that when a channel is busy the messages directed into it are stored at the station, joining there a queue which is governed by a first-come first-served service discipline. Assuming messages, with fixed length, to arrive at random at the network, following the statistics of a Poisson point process, the author calculates the statistical characteristics of the messages time-delay along a path in a communication network. The author solves for the steady-state distributions of the message waiting-times along the path, for the distribution of the overall message delay-time, for the average memory size requirements at the stations, as well as for other statistical characteristics of the message flow and the queueing processes along a communication path. (Modified author abstract) GRA

N74-19885# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MULTISTABLE ELEMENTS WITH BRIDGE TIME-GIVING CIRCUITS BASED ON INTEGRATED MICROCIRCUITS
P. N. Dimitraki and S. N. Dimitraki 11 Dec. 1973 8 p refs Transl. into ENGLISH from Avtomat. Vychisl. Tekh. (Riga), no. 4, 1972 p 84-85
(AD-773287; FTD-HT-23-605-74) Avail: NTIS CSCL 09/5

The authors present a multistable element system with bridge time-giving circuits based on integrated microcircuits and the results of an experimental study. GRA

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N74-19886 Rensselaer Polytechnic Inst., Troy, N.Y.
SYSTEM DESIGN OPTIMIZATION FOR A MARS-ROVING VEHICLE AND PERTURBED-OPTIMAL SOLUTIONS IN NONLINEAR PROGRAMMING Ph.D. Thesis
Carl Pavarini 1973 176 p
Avail: Univ. Microfilms Order No. 74-5152

Work is presented in two distinct areas. First, the optimal system design problem for a Mars-roving vehicle is attacked by creating static system models and a system evaluation function and optimizing via nonlinear programming techniques. The second area concerns what will be termed the problem of perturbed-optimal solutions. Given an initial perturbation in an element of the solution to a nonlinear programming problem, a linear method is determined to approximate the optimal readjustments of the other elements of the solution. Then, the sensitivity of the Mars rover designs is described by application of this method. Dissert. Abstr.

N74-19887 Michigan Univ., Ann Arbor.
THE SHOCK TUBE AS A CONTROLLED-TEMPERATURE EXCITATION SOURCE FOR SPECTROCHEMICAL ANALYSIS Ph.D. Thesis
Vincent Thomas Cordasco 1973 227 p
Avail: Univ. Microfilms Order No. 74-3602

The development was studied of the bursting diaphragm shock tube as a controlled-temperature excitation source for spectrochemical analysis. The temperature of shock-heated gas in a conventional pressure driven shock tube can be controlled reproducibly from ambient to about 20,000 K. The methods and instrumentation required to obtain and control any desired temperature in this range are considered. The instrumentation needed for analog and digital methods of shock velocity measurement, which permits temperature calculation, is considered. The instrumentation used for optical monitoring of emitted radiation from the shock-heated gas is discussed in addition to the design of instrumentation necessary to acquire time resolution of the radiation. The theory of shock-tube excitation is discussed

including consideration of real gas effects, gas flow in the tube, boundary layer effects, and sample effects on shock region temperatures and observation times in the shock-heated gases.
Dissert. Abstr.

N74-19888*# Martin Marietta Aerospace, Denver, Colo.
VIKING '79 ROVER STUDY. VOLUME 1: SUMMARY REPORT Final Report
Mar. 1974 116 p refs 2 Vol.
(Contract NAS1-12425)
(NASA-CR-132417) Avail: NTIS HC $9.00 CSCL 13F

The results of a study to define a roving vehicle suitable for inclusion in a 1979 Viking mission to Mars are presented. The study focused exclusively on the 1979 mission incorporating a rover that would be stowed on and deployed from a modified Viking lander. The overall objective of the study was to define a baseline rover, the lander/rover interfaces, a mission operations concept, and a rover development program compatible with the 1979 launch opportunity. During the study, numerous options at the rover system and subsystem levels were examined and a baseline configuration was selected. Launch vehicle, orbiter, and lander performance capabilities were examined to ensure that the baseline rover could be transported to Mars using minimum-modified Viking '75 hardware and designs. Author

N74-19889*# Martin Marietta Aerospace, Denver, Colo.
VIKING '79 ROVER STUDY. VOLUME 2: DETAILED TECHNICAL REPORT Final Report
Mar. 1974 404 p refs 2 Vol.
(Contract NAS1-12425)
(NASA-CR-132418) Avail: NTIS HC $23.25 CSCL 13F
For abstract, see N74-19888.

N74-19890*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE GEORGE C. MARSHALL SPACE FLIGHT CENTER HIGH REYNOLDS NUMBER WIND TUNNEL TECHNICAL HANDBOOK
H. S. Gwin Dec. 1973 48 p refs
(NASA-TM-X-64831) Avail: NTIS HC $5.50 CSCL 14B

A description, presented in handbook form for the potential user, is given of the high Reynolds number wind tunnel. The following items are presented to illustrate the operation and capabilities of the facility: facility description and specifications, operational and performance characteristics, model design criteria, instrumentation and data recording equipment, data processing and presentation, and preliminary test information required.
Author

N74-19891# National Aerospace Lab., Tokyo (Japan).
DESIGN AND DEVELOPMENT OF THE GUST WIND TUNNEL AT THE NATIONAL AEROSPACE LABORATORY
Kenichi Hirosue, Kiyomi Kitamura, Yoshitaka Murakami, and Shigemi Shindo Sep. 1973 30 p refs In JAPANESE; ENGLISH summary
(NAL-TR-335) Avail: NTIS HC $4.50

A gust wind tunnel, of the single return type, for performing tests under normal atmospheric conditions is described. The wind tunnel is equipped with two interchangable test sections with a 2 m square cross section; one section is normally closed while the other is a semi-closed section with gust generators. The latter section is used for simulated tests of aircraft gust response and gust load. A six component pyramid type balance and a data processing system are also contained in the wind tunnel. Gusts in the test section are generated by oscillatory cascade wings installed at the upstream part of the semi-closed section, and simulates one dimensional vertical gusts with various frequencies and amplitudes. The vertical component of the resulting air flow appeared to follow the desired command signal and was understood to be capable of satisfactorily simulating various gusts. For the normal closed section, the maximum capable speed was 67 m/sec, the turbulence factor was 1.02, and the velocity deviation within the cross section was suppressed to within + or - 1 % of the mean velocity at that section. Author

N74-19892*# Rocketdyne, Canoga Park, Calif.
LINEAR TEST BED. VOLUME 1: TEST BED NO. 1 Final Report
30 Aug. 1972 252 p
(Contract NAS8-25156)
(NASA-CR-120184; R-9049-Vol-1) Avail: NTIS HC $15.75 CSCL 14B

The Linear Test Bed program was to design, fabricate, and evaluation test an advanced aerospike test bed which employed the segmented combustor concept. The system is designated as a linear aerospike system and consists of a thrust chamber assembly, a power package, and a thrust frame. It was designed as an experimental system to demonstrate the feasibility of the linear aerospike-segmented combustor concept. The overall dimensions are 120 inches long by 120 inches wide by 96 inches in height. The propellants are liquid oxygen/liquid hydrogen. The system was designed to operate at 1200-psia chamber pressure, at a mixture ratio of 5.5. At the design conditions, the sea level thrust is 200,000 pounds. The complete program including concept selection, design, fabrication, component test, system test, supporting analysis and posttest hardware inspection is described. Author

N74-19893*# Rocketdyne, Canoga Park, Calif.
LINEAR TEST BED. VOLUME 2: TEST BED NO. 2 Final Report
27 Mar. 1974 208 p refs
(Contract NAS8-25156)
(NASA-CR-120183; R-9049-Vol-2) Avail: NTIS HC $13.50 CSCL 14B

Test bed No. 2 consists of 10 combustors welded in banks of 5 to 2 symmetrical tubular nozzle assemblies, an upper stationary thrust frame, a lower thrust frame which can be hinged, a power package, a triaxial combustion wave ignition system, a pneumatic control system, pneumatically actuated propellant valves, a purge and drain system, and an electrical control system. The power package consists of the Mark 29-F fuel turbopump, the Mark 29-0 oxidizer turbopump, a gas generator assembly, and propellant ducting. The system, designated as a linear aerospike system, was designed to demonstrate the feasibility of the concept and to explore technology related to thrust vector control, thrust vector optimization, improved sequencing and control, and advanced ignition systems. The propellants are liquid oxygen/liquid hydrogen. The system was designed to operate at 1200-psia chamber pressure at an engine mixture ratio of 5.5. With 10 combustors, the sea level thrust is 95,000 pounds. Author

N74-19894# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SELECTION OF LANDING FIELDS
M. Finikov 30 Nov. 1973 11 p refs Transl. into ENGLISH from Grazhdanskaya Aviat. (USSR), no. 3, Mar. 1973 p 21
(AD-772051; FTD-HT-23-536-74) Avail: NTIS CSCL 01/5

There is special importance in the selection of sites of support airfields for the group disposition of aircraft and helicopters. Here it is necessary to calculate the optimum zone of location of the agricultural airfield. Taken as the optimum zone is the section of land area remote from the tillable fields at a distance proportional to their total areas. GRA

N74-19895# Mitre Corp., Bedford, Mass.
STAR FIELD SIMULATOR
J. W. Leahey Dec. 1973 32 p
(Contract F19628-73-C-0001; AF Proj. 6290)
(AD-772818; MTR-2633; ESD-TR-73-296) Avail: NTIS CSCL 14/2

The spatial and intensity distribution of stars in a one square degree area of the night sky is discussed. A technique and instrument to achieve a simulation of the night sky is described and the output parameters are defined. Author (GRA)

N74-19896# National Aviation Facilities Experimental Center, Atlantic City, N.J.
EVALUATION OF IDENTIFICATION BEACONS FOR AIRPORT EMERGENCY VEHICLES Final Report, Apr. - Aug. 1973
Bret B. Castle Jan. 1974 32 p
(AD-773445; FAA-NA-73-93; FAA-RD-73-196) Avail: NTIS CSCL 01/5

The purpose of this effort was to determine the effectiveness

of several newly developed identification beacons for airport emergency vehicles. Fourteen different light bar configurations were tested on the National Aviation Facilities Experimental Center (NAFEC) airport during various environmental conditions and a human appraisal of the different combinations was performed for suitable airport use. The results lead to conclusions as to which signal characteristics are most effective for use within the aircraft movement areas of airports. Author (GRA)

N74-19897# Air Force Weapons Lab., Kirtland AFB, N.Mex.
EVALUATION OF RUNWAY SKID-RESISTANCE CHARACTERISTICS AT SPANGDAHLEM AIR BASE, GERMANY Final Report, 1 Nov. 1972 - 30 Jun. 1973
George D. Ballentine and Phil V. Compton Jan. 1974 35 p (AF Proj. 683M)
(AD-773805; AFWL-TR-73-239) Avail: NTIS CSCL 01/5

Data gathered during the Air Force Weapons Laboratory (AFWL) standard skid-resistance test conducted at Spangdahlem AB, Germany, on 10 November 1972, are analyzed. The test results indicate the runway surface had good skid-resistance properties and no corrective action was indicated at the time of the test. Author (GRA)

N74-19898# Environmental Protection Agency, Arlington, Va. Task Group 1
LEGAL AND INSTITUTIONAL ANALYSIS OF AIRCRAFT AND AIRPORT NOISE AND APPORTIONMENT OF AUTHORITY BETWEEN FEDERAL, STATE, AND LOCAL GOVERNMENTS Final Report
Elizabeth Cuadra 27 Jul. 1973 413 p refs
(PB-225149/4GA; EPA-NTID-73.2) Avail: NTIS HC $8.25 CSCL 01E

Data pertinent to legal and institutional analysis of aircraft and airport noise and apportionment of authority between Federal, State, and local governments are presented. The report is an interpretation of such data by the task group chairperson responsible for this specific report. It does not necessarily reflect the official views of EPA and does not constitute a standard, specification, or regulation. Author (GRA)

N74-20043 Bundesminister fuer Verteidigung, Bonn (West Germany). Erprobungsstelle 91.
PHYSICAL FUNDAMENTALS OF A MOBILE, IMMATERIAL TARGET PLATE [PHYSIKALISCHE GRUNDLAGEN EINER MOBILEN, IMMATERIELLEN TREFFBILDSCHEIBE]
Wolfgang Schumann *In* Inst. Franco-Allemand de Rech. Meas. Methods in Ballistics 1973 p 259-269 In GERMAN (For availability see N74-20028 11-14)

N74-20044 Laboratoire Central de l'Armement, Arcueil (France). Dept. Electronique.
AUTOMATIC TARGET [CIBLE AUTOMATIQUE]
Serge Perechodkin *In* Inst. Franco-Allemand De Rech. Meas. Methods in Ballistics 1973 p 271-289 In FRENCH (For availability see N74-20028 11-14)

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N74-19899 Ohio State Univ., Columbus.
INVESTIGATION OF TEST FACILITY ENVIRONMENTAL FACTORS AFFECTING SHOCK TUBE SIDEWALL BOUNDARY LAYER TRANSITION Ph.D. Thesis
James Christopher Boison 1973 170 p
Avail: Univ. Microfilms Order No. 74-3123

Gasdynamic and dynamic environmental factors affecting boundary layer transition were investigated. Tests were conducted on the sidewall boundary layer of a shock tube having a four inch I.D., five foot long test section instrumented with heat gages, microphones and accelerometers. The test map covered a range of shock Mach numbers from three to fifteen and unit Reynolds number from 0.5 x 10 to the 6th power to 4 x 10 to the 6th power per foot. Besides the usual factors affecting boundary layer transition such as wall cooling, Mach number and unit Reynolds number, dynamic factors related to accelerometer and microphone outputs in terms of statistically derived correlation functions and power spectra were also analyzed. Transition data obtained in the present study provided enough detailed information to define a multiple transition reversal curve for a fixed unit Reynolds number of 0.5 x 10 to the 6th power per foot. Dissert. Abstr.

N74-19900 California Univ., San Diego.
TRUBULENT MIXING OF TEMPERATURE IN WATER, AIR AND MERCURY Ph.D. Thesis
John Parley Clay 1973 64 p
Avail: Univ. Microfilms Order No. 74-3607

Measurements of velocity and temperature were carried out in a mercury tunnel, water tunnel, the ocean, a heated air jet, and the atmospheric boundary layer over the ocean to test various hypotheses on the mixing of passive scalar properties by turbulent flow. Spectral distributions were scaled with measured dissipation rates of turbulent kinetic energy and scalar variance, the kinematic viscosity v and diffusivity of temperature D according to various universal similarity hypotheses to test for universal spectral forms as a function of Prandtl number. Dissert. Abstr.

N74-19901 Southern Methodist Univ., Dallas, Tex.
BOILING HEAT TRANSFER TO A FREON-113 JET IMPINGING UPWARD ONTO A FLAT, HEATED SURFACE Ph.D. Thesis
Michael Alan Ruch 1973 114 p
Avail: Univ. Microfilms Order No. 74-4607

An experimental investigation was conducted on the boiling heat transfer characteristics of a liquid Freon-113 jet impinging vertically upward onto a heated test surface. This test surface was the flat end of an electrically heated, nickel-plated, 0.508 inch diameter copper cylinder. Test variables were jet velocity, jet nozzle inside diameter, test surface orientation, and surface temperature. Total heat transfer and heat flux measurements were made. Incomplete coverage of the test surface by fluid was obtained for most of the experiments, and the variable heat transfer area, called the area of contact, was measured using photographic techniques. Dimensional correlations of the heat transfer and heat flux data in both nucleate and film boiling were obtained in terms of the four test variables. Dissert. Abstr.

N74-19902*# Michigan State Univ., East Lansing. Div. of Engineering Research.
RESEARCH ON FREE AND IMPINGING JETS FOR THE DEVELOPMENT OF STOL AIRCRAFT Final Report
John F. Foss and Stanley J. Kleis 21 Jan. 1974 39 p refs (Grant NGR-23-004-068)
(NASA-CR-138031) Avail: NTIS HC $5.00 CSCL 20D

The effect of the exit plane conditions on the initial region of an axisymmetric jet was systematically investigated. An essentially top-hat mean velocity profile and a homogeneous turbulence structure were maintained at the exit plane for eight distinct scale and intensity conditions. Mass and momentum flux values are independent of the exit turbulence structure for the range investigated; however, a significant (approximately 25%) increase in the latter implies a pronounced static pressure decrement inside the jet. Details of the velocity profile and turbulence structure are influenced by the exit plane conditions. The three radial-axial components of the Reynolds stress tensor have been conditionally sampled and are analyzed to show the initial condition effects. Author

N74-19903*# Ohio State Univ. Research Foundation, Columbus. Dept. of Aeronautical and Astronautical Engineering.
TEMPERATURE MEASUREMENTS BEHIND REFLECTED SHOCK WAVES IN AIR Final Report, 1 Apr. 1971 - 31 Jul. 1972
Jon B. Bader, Robert M. Nerem, Jonathan B. Dann, and Michael A. Culp 7 Sep. 1972 63 p refs
(Grant NGR-36-008-163; RF Proj. 3211-A1)
(NASA-CR-132398) Avail: NTIS HC $6.25 CSCL 20D

A radiometric method for the measurement of gas temperature in self-absorbing gases has been applied in the study of shock tube generated flows. This method involves making two absolute

intensity measurements at identical wavelengths, but for two different pathlengths in the same gas sample. Experimental results are presented for reflected shock waves in air at conditions corresponding to incident shock velocities from 7 to 10 km/s and an initial driven tube pressure of 1 torr. These results indicate that, with this technique, temperature measurements with an accuracy of + or - 5 percent can be carried out. The results also suggest certain facility related problems. Author

N74-19904*# Scientific Translation Service, Santa Barbara, Calif.
STABILITY AND DECAY OF FREE VORTICES BEHIND A WING
H. Bippes Washington NASA Apr. 1974 10 p Transl. into ENGLISH from DEVLR-Nachrichten (West Germany), Oct. 1973 p 455-457
(Contract NASw-2483)
(NASA-TT-F-15445; A74-11805) Avail: NTIS HC $4.00 CSCL 20D

An experimental investigation was conducted regarding the system of free vortices which detach themselves from a rectangular wing. During the tests the model was moved while the fluid medium remained at rest. This approach made it possible to observe the vortices for more than one minute until they finally decayed. The flow was made visible with the aid of hydrogen bubbles which were obtained by electrolysis of the medium water by means of a wire serving as cathode. Author

N74-19905*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TWO-PHASE CHOKED FLOW OF SUBCOOLED NITROGEN THROUGH A SLIT
Robert J. Simoneau 12 Apr. 1974 15 p refs Presented at the Southeastern Seminar on Thermal Sci., New Orleans, 11-12 Apr. 1974
(NASA-TM-X-71516) Avail: NTIS HC $4.00 CSCL 20D

Two-phase choked flow rate and pressure distribution data are reported for subcooled nitrogen flowing through a slit. The slip was a narrow rectangular passage of equal length and width. The inlet stagnation pressure ranged from slightly above saturation to twice the thermodynamic critical pressure. Four stagnation isotherms were investigated covering a range which spanned the critical temperature. The results suggested a uniform two-phase flow pattern with vaporization occurring at or near the exit in most cases. The results compared favorably with the theory of Henry for nonequilibrium subcooled two-phase choked flow in long tubes. Author

N74-19906# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
HYDRAULIC RESEARCH IN THE UNITED STATES AND CANADA, 1972
Gershon Kulin, ed. and Pauline H. Gurewitz, ed. Jan. 1974 341 p refs
(NBS-SP-382) Avail: SOD HC $3.00 as C13.46.382

Current and recently concluded research projects in hydraulics and hydrodynamics for the years 1971-1972 are summarized. Projects from more than 250 university, industrial, State and Federal government laboratories in the United States and Canada are reported. Author

N74-19907*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPERIMENTAL STUDY OF SHARP AND BLUNT NOSE STREAMWISE CORNERS AT MACH 20
Ralph D. Watson Washington Apr. 1974 79 p refs
(NASA-TN-D-7398; L-8830) Avail: NTIS HC $4.00 CSCL 20D

Extensive heat transfer and pressure distribution data and oil flow studies on sharp and blunt-nose streamwise corners at Mach 20 in helium are presented. The far corner boundary layers on the wedge surfaces forming the corners are laminar for most test conditions. Analysis of the data indicates that the corner flow field geometry can be described in terms of the inviscid shock pattern on the two dimensional surfaces forming the corner. Parameters used to correlate blunt shock growth can be used to correlate features of the flow field observed in oil flow photographs in addition to the measured pressure and heat transfer distributions on the models. The flow field structure is described from available experimental data. Regions of the flow in which the structure still is not known are discussed. Author

N74-19908*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A REVIEW OF TURBULENCE MEASUREMENTS IN COMPRESSIBLE FLOW
V. A. Sandborn Mar. 1974 76 p refs
(NASA-TM-X-62337) Avail: NTIS HC $7.00 CSCL 20D

A survey of turbulence measurements in compressible flows is presented. The majority of turbulence measurements at super- and hypersonic speeds were made for the zero pressure gradient, turbulent boundary layer. It was found that the nondimensional turbulent stress terms for the zero pressure gradient flow appear to agree closely with equivalent incompressible measurements in the outer part of the boundary layer. The stress terms were nondimensionalized by the wall value of shear stress and plotted versus the distance from the wall, nondimensionalized by the boundary-layer thickness. Indirect evaluation of the total shear stress distribution from mean velocity measurements for both super- and hypersonic flows (zero pressure gradient, two-dimensional flows) indicate a near universal distribution. These total shear stress curves also agree very closely with measured incompressible shear stress distributions. Recent laser anemometer measurements of the turbulent Reynolds shear stress (puv), reported by Johnson and Rose for a Mach number 2.9 flow, are in reasonable agreement with the expected total shear stress curve over the outer 60% of the boundary layer. Author

N74-19909# National Aerospace Lab., Tokyo (Japan).
A NON-LINEAR HYDRODYNAMIC STABILITY THEORY WITH NUMERICAL CALCULATIONS. PART 1: A POWER SERIES METHOD FOR THE NUMERICAL TREATMENT OF THE ORR-SOMMERFELD EQUATION
Nobutake Itoh Jul. 1973 11 p refs In JAPANESE; ENGLISH summary
(NAL-TR-331-Pt-1) Avail: NTIS HC $4.00

A boundary value problem of a linear ordinary differential equation of the fourth order is solved numerically. The equation treated here has the generalized form of the Orr-Sommerfeld equation which arises from hydrodynamic stability theory. The method of solution consists of power series solutions, matrix representation of the solutions and transformation of the matrices. The method is highly accurate for the calculation of eigenvalues in linearized problems and can also be applied to nonlinear problems in the stability theory. The solutions are obtained for spatially growing infinitesimal disturbances in plane Poiseuille flow and in Blasius flow. The minimum critical Reynolds number is found to be 5771 for Poiseuille flow and 546 for Blasius flow. Author

N74-19910# National Aerospace Lab., Tokyo (Japan).
A NON-LINEAR HYDRODYNAMIC STABILITY THEORY WITH NUMERICAL CALCULATIONS. PART 2: THEORETICAL ANALYSIS AND THE NUMERICAL RESULTS FOR PLANE POISEUILLE FLOW
Nobutake Itoh Jul. 1973 16 p refs In JAPANESE; ENGLISH summary
(NAL-TR-332-Pt-2) Avail: NTIS HC $4.00

A method of analysis for studying the development of two-dimensional, finite disturbances leading to transition from laminar to turbulent flow is presented. The expansion method for analysis of the non-linear basic equation constitutes an extension and modification of the Stuart-Watson approach. Three points are considered essential: (1) the fundamental disturbance is assumed to be a spatially-growing wave instead of a temporally-growing one; (2) the solution of the equation for mean-flow distortion consists of both an eigenfunction component with an arbitrary coefficient and a particular solution; (3) the damping of the first approximation to the fundamental wave remains unknown through the formulation. These modifications lead to a relation between the amplitude of the fundamental wave and the magnitude of the mean-flow distortion, which provides a lucid explanation of the non-linear mechanism of disturbances. It is also found that the damping of the fundamental wave does not vary linearly with the square of the amplitude but varies according to a more complicated law. The method is

applied to plane Poiseuille flow and the numerical results are obtained for a wide range of frequency and Reynolds number.
Author

N74-19911# National Aerospace Lab., Tokyo (Japan).
A NON-LINEAR HYDRODYNAMIC STABILITY THEORY WITH NUMERICAL CALCULATIONS. PART 3: NUMERICAL RESULTS FOR THE FLAT PLATE BOUNDARY LAYER
Nobutake Itoh Jul. 1973 11 p refs In JAPANESE; ENGLISH summary
(NAL-TR-333-Pt-3) Avail: NTIS HC $4.00

The non-linear theory previously for parallel flows is applied to a nearly parallel flow in the boundary layer on a flat plate. Both the variation of the boundary-layer thickness with distance downstream and the normal component of the velocity of the basic steady flow are taken into consideration for solution of the equation for mean-flow distortion. Numerical calculations are carried out for a range of values of frequency and Reynolds number. The results are exhibited in the form of a stability diagram for finite disturbances, which is found to be similar to that for the plane Poiseuille flow. Moreover, a detailed investigation is made of the behavior of disturbances in the vicinity of the upper branch of the neutral curve for infinitesimal disturbances.
Author

N74-19912*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DIFFERENTIAL ANALYSIS FOR THE TURBULENT BOUNDARY LAYER ON A COMPRESSOR BLADE ELEMENT (INCLUDING BOUNDARY-LAYER SEPARATION)
James F. Schmidt and Carroll A. Todd Washington Apr. 1974 31 p refs
(NASA-TN-D-7635 ; E-7506) Avail: NTIS HC $3.25 CSCL 20D

A two-dimensional differential analysis is developed to approximate the turbulent boundary layer on a compressor blade element with strong adverse pressure gradients, including the separated region with reverse flow. The predicted turbulent boundary layer thicknesses and velocity profiles are in good agreement with experimental data for a cascade blade, even in the separated region.
Author

N74-19913*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF THEORETICAL AND EXPERIMENTAL BOUNDARY-LAYER DEVELOPMENT IN A MACH 2.5 MIXED-COMPRESSION INLET
Warren R. Hingst and Charles E. Towne Washington Apr. 1974 32 p refs
(NASA-TM-X-3026; E-7586) Avail: NTIS HC $3.25 CSCL 20D

An analytical investigation was made of the boundary layer flow in an axisymmetric Mach 2.5 mixed compression inlet, and the results were compared with experimental measurements. The inlet tests were conducted in the Lewis 10- by 10-foot supersonic wind tunnel at a unit Reynolds number of 8.2 million/m. The inlet incorporated porous bleed regions for boundary layer control, and the effect of this bleed was taken into account in the analysis. The experimental boundary layer data were analyzed by using similarity laws from which the skin friction coefficient was obtained. The boundary layer analysis included predictions of laminar and turbulent boundary layer growth, transition, and the effects of the shock boundary layer interactions. In addition, the surface static pressures were compared with those obtained from an inviscid characteristics program. The results of investigation showed that the analytical techniques gave satisfactory predictions of the boundary layer flow except in regions that were badly distorted by the terminal shock.
Author

N74-19914*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
VENTING CHARACTERISTICS OF GASEOUS HELIUM AND NITROGEN DISCHARGING INTO A FREE STREAM AT MACH NUMBERS FROM 0.60 TO 1.57
Albert L. Johns and Merle L. Jones Washington Apr. 1974 18 p refs
(NASA-TM-X-2995; E-7698) Avail: NTIS HC $3.00 CSCL 20D

An experimental investigation was conducted in the Lewis Research Center 8- by 6-Foot Supersonic Wind Tunnel to compare the effects on discharge coefficient of venting gaseous helium and gaseous nitrogen into a free stream. The test was conducted from Mach 0.06 to 1.57 with the vent mounted in a flat plate. The plate was strut mounted to the tunnel ceiling and at a 0 angle of attack. The gases were discharged from a plenum chamber through a 2.54-centimeter (1.00-in.) diameter vent. The ratio of local static pressure to plenum pressure was varied from 0.51 to 0.975. The ratio of boundary layer thickness to vent diameter varied from a maximum of 1.34 at Mach 0.60 to a minimum of 0.55 at Mach 1.37.
Author

N74-19915*# Texas A&M Univ., College Station.
HYDRODYNAMIC WATER IMPACT Final Report
C. F. Kettleborough Mar. 1972 23 p refs
(Grant NGR-44-001-071)
(NASA-CR-137370) Avail: NTIS HC $4.25 CSCL 20D

The hydrodynamic impact of a falling body upon a viscous incompressible fluid was investigated by numerically solving the equations of motion. Initially the mathematical model simulated the axisymmetric impact of a rigid right circular cylinder upon the initially quiescent free surface of a fluid. A compressible air layer exists between the falling cylinder and the liquid free surface. The mathematical model was developed by applying the Navier-Stokes equations to the incompressible air layer and the incompressible fluid. Assuming the flow to be one dimensional within the air layer, the average velocity, pressure and density distributions were calculated. The liquid free surface was allowed to deform as the air pressure acting on it increases. For the liquid the normalized equations were expressed in two-dimensional cylindrical coordinates. The governing equations for the air layer and the liquid were expressed in finite difference form and solved numerically. For the liquid a modified version of the Marker-and-Cell method was used. The mathematical model has been reexamined and a new approach has recently been initiated. Essentially this consists of examining the impact of an inclined plate onto a quiesent water surface with the equations now formulated in cartesian coordinates.
Author

N74-19916# Technische Univ., Berlin (West Germany). Inst. fuer Kerntechnik.
ANALYSIS SOLUTIONS FOR THE VELOCITY FIELDS IN LONGITUDINAL LAMINAR FLOW IN FINITE ROD BUNDLES OF ARBITRARY ARRANGEMENT Ph.D. Thesis
Reza Mottaghian Jul. 1973 135 p refs In GERMAN; ENGLISH summary
(TUBIK-25) Avail: AEC Depository Libraries HC $8.75

An analytical method for calculation of fully developed, longitudinal laminar flow in finite rod bundles with more than one ring of rods of arbitrary arrangement is presented. Two-dimensional velocity fields, local wall shear stress distributions, pressure drops, and total friction factors are given as functions of rod arrangement, radial displacement of rod rings, pitch-to-diameter ratio, tube wall spacing, number of rods, and number of rod rings.
Author (NSA)

N74-19917# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Aerospace Engineering.
BOUNDARY LAYER FLOWS OVER SHARP AND SPHERICALLY BLUNTED CONES AT ANGLE OF ATTACK TO SUPERSONIC NONUNIFORM FREE STREAMS. VOLUME 2: DESCRIPTION OF COMPUTER PROGRAMS AND USER'S GUIDE Final Report
Michael C. Frieders and Clark H. Lewis Aug. 1973 168 p refs
(Contract F33615-70-C-1015; AF Proj. 7064)
(AD-773057; ARL-73-0123-Vol-2) Avail: NTIS CSCL 20/4

Two FORTRAN computer programs have been developed to solve the problem of laminar boundary layers on sharp and blunt cones at angle of attack to nonuniform free streams. An existing three-dimensional boundary layer program was modified to introduce nonuniform edge properties to the boundary layer on a sharp cone. A combination of axisymmetric and three-dimensional boundary layer programs was modified to solve the boundary layer on a blunt cone in nonuniform streams. The inviscid flow fields over blunt cones are predicted from blunt body and three-dimensional method of characteristics solutions.

Conical flow field solutions are used over sharp cones in uniform streams, and three-dimensional method of characteristics solutions are used over sharp cones in nonuniform streams. (Modified author abstract) GRA

N74-19918# Technology, Inc., Dayton, Ohio.
RELATIONS BETWEEN SOLUTIONS OF THE NAVIER-STOKES EQUATIONS AND OF THE BOUNDARY LAYER EQUATION
Karl G. Guderley and S.-L. Wen Nov. 1973 65 p
(Contract F33615-71-C-1463; AF Proj. 7071)
(AD-773183; ARL-73-0165) Avail: NTIS CSCL 20/4

The relations between solutions of the full Navier-Stokes equations and of the boundary layer equations are explored by a discussion of the eigensolutions of a model equation which retains the essential features of the problem. Important are the following results. The system of eigensolutions for the full Navier-Stokes equations is not well suited to represent numerically the concentration of vorticity occurring in the boundary layer. Restriction of the viscosity effect to a layer close to the wall is therefore desirable from a numerical point of view. With this provision the boundary layer equation, including a subsequent correction for its displacement thickness, reproduces perturbations of the Navier-Stokes equations which correspond to potential flow solutions (with wall corrections) and to vorticity effects propagating downstream. The Navier-Stokes equations allow for effects propagating upstream; they are confined to a narrow layer close to the wall within the boundary layer and die out very quickly. In the vicinity of a separation point these solutions gain greater importance. Author (GRA)

N74-19919# Applicazioni e Ricerche Scientifiche, Naples (Italy).
SOME RECENT RESULTS IN RAREFIED GAS DYNAMICS Final Scientific Report, 1 Aug. 1971 - 31 Jul. 1973
Carlo Cercignani Jul. 1973 29 p refs
(Contract F44620-71-C-0121; AF Proj. 9783)
(AD-772803; AFOSR-73-2137TR) Avail: NTIS CSCL 20/4

The report summarizes some of the work done during the reporting period. Two topics are discussed: the first is related to the general theory of the Boltzmann equation, the second to the effects of gas-surface interaction on the recovery temperature in free-molecular flow. The general solution of the linearized Boltzmann equation for one dimensional steady problems is presented. GRA

N74-19920# RCA Research Labs., Sainte Anne de Bellevue (Quebec).
ANALYSIS OF TURBULENT FLOW IN WALL-STABILIZED ARC DISCHARGES Final Scientific Report, 1 Feb. 1972 - 1 Apr. 1973
Issie P. Shkarofsky Nov. 1973 132 p refs
(Contract F33615-72-C-1729; AF Proj. 7063)
(AD-773193; MNLD-73-TR-003; PSP-108; ARL-73-0133) Avail: NTIS CSCL 20/9

The report concerns the analysis of turbulent flow in wall-stabilized arcs. A plausible formulation is offered relating the changes in resistivity or average voltage gradient at high flow rates to the fluctuations in gas temperature and velocity. A four fold increase with flow rate in voltage gradient as observed by Frind and Damsky in an argon arc can be accounted for by a 10 to 20 percent rms fluctuation in gas temperature. The increase also depends on the ratio of electron neutral collision frequency to the total collision frequency and thus tends to become smaller as the gas becomes singly ionized. In transitions to higher order Z-ionizations, the theory predicts that the average resistivity may be slightly increased, and then with a rise in temperature it is decreased below its nonturbulence values. (Modified author abstract) GRA

N74-19921# Polytechnic Inst. of Brooklyn, Farmingdale, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
SLENDER BODY THEORY FOR THREE-DIMENSIONAL BOUNDARY-LAYER INDUCED POTENTIAL FLOWS Interim Report
Stanley G. Rubin and Frank J. Mummolo Aug. 1973 34 p refs
(Grant AF-AFOSR-1843-70; AF Proj. 9781)
(AD-773362; PIBAL-73-16; AFOSR-74-0039TR) Avail: NTIS CSCL 20/4

The application of slender body theory for the evaluation of three-dimensional boundary layer induced surface crossflow and streamwise velocities is considered. The method is applicable to sub- and supersonic flows when small perturbation theory applies, and when the Reynolds number is large so that the thin boundary layer approximation is valid. The resulting potential problem is, in general, reduced to a two-dimensional consideration of the flow over an expanding cylinder with porous boundary conditions. As a model problem, the induced surface velocities are determined for the constant density flow over a body with constant elliptical cross-section. The limiting solutions for a flat plate of finite span and a near circular cross-section are obtained in a simple analytic form. In the former case, within the limitations of slender body theory, the results are in exact agreement with the complete three-dimensional solution for this geometry. Author (GRA)

N74-19922# University Coll., Cork (Ireland). Dept. of Mathematical Physics.
PHYSICS OF THE VORTEX CORE
P. D. McCormack Nov. 1973 36 p refs
(Grant AF-AFOSR-2222-72; AF Proj. 9711)
(AD-773366; AFOSR-74-0040TR) Avail: NTIS CSCL 20/4

The report discusses the kinetic theory of the vortex core. Included are discussions of the vorticity, dissipation and the curvature function; kinetic theory of the vortex core gas; and, transport and optical properties of the core gas. GRA

N74-19923# Naval Postgraduate School, Monterey, Calif.
SIMULATION OF HYDROFOIL PERFORMANCE IN CALM WATER M.S. Thesis
Gary Dee Hickox Dec. 1973 92 p refs
(AD-772876) Avail: NTIS CSCL 13/10

A digital computer simulation program using Digital Simulation Language is produced to study the performance of a hydrofoil in calm water. Various automatic control systems are studied with the model constrained to the pitch-heave-surge mode of operation. Author (GRA)

N74-19924# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ASYMTOTICS OF A REACTING DISTANT WAKE
L. I. Skurin Dec. 1973 13 p refs Transl. into ENGLISH from Teplo- i Massoperenos (USSR), v. 1, 1972 p 167-171
(AD-773275; FTD-HT-23-414-74) Avail: NTIS CSCL 20/4

The paper examines a system of equations of a boundary layer, which includes an equation describing the flow in an axisymmetric (laminar or turbulent) wake. GRA

N74-19925# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EVALUATION OF THE ROOT-MEAN-SQUARE VALUE FOR THE PULSATIONS OF A CONCENTRATION OF A NONCONSERVATIVE IMPURITY IN THE WAKE BEHIND A BODY
L. I. Skurin 11 Dec. 1973 16 p refs Transl. into ENGLISH from Teplo- i Massoperenos (Minsk), v. 1, 1972 p 218-227
(AD-773273; FTD-HT-23-370-74) Avail: NTIS CSCL 16/2

The report examines an axisymmetric distant turbulent wake behind a body which has gas with a low reactive impurity content flowing around it. Paragraph 1 derives and closes semiempirically the equations of balance for the rms value of impurity pulsations. Paragraph 2, using the intergral method, reduces the problem to a system of ordinary differential equations. Paragraph 3 presents the results of calculating the parameters of the wake behind a body around which argon is flowing. GRA

N74-19926# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HEAT AND MASS TRANSFER IN JETS
Z. G. Shaikhugdinov, F. G. Bakirov, and A. Ya. Nadyrshin 11 Dec. 1973 10 p refs Transl. into ENGLISH from Teplo- i Massoperenos (Minsk), v. 1, 1972 p 161-166
(AD-773515; FTD-HT-23-369-74) Avail: NTIS CSCL 20/4

An experimental study was made of the distribution of the heat transfer coefficient and the propagation of an injected mass on a wall in the region where the injected stream interacts with

a supersonic carrier current. Also studied are the development characteristics of the injected jet in the main flow, which are then compared with similar characteristics for standard submerged and wake streams. GRA

N74-19927# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RADIATIVE-CONVECTION HEAT EXCHANGE AND MASS TRANSFER
A. B. Karasev, A. N. Lyakh, and S. A. Pegov 9 Jan. 1974 11 p refs Transl. into ENGLISH from Teplo- i Massoperenos (Minsk), v. 1, no. 2, 1972 p 402-408
(AD-773518; FTD-HT-23-396-74) Avail: NTIS CSCL 20/4
The report develops a theoretical study of hypersonic flow of hydrogen around a spherical body. GRA

N74-19928# Ballistic Research Labs., Aberdeen Proving Ground, Md.
LASER INTERFEROMETRY OF UNSTEADY, UNDER-EXPANDED JETS
Fritz H. Oertel, Jr. Jan. 1974 25 p refs
(AD-773664; BRL-1694) Avail: NTIS CSCL 20/4
The report describes an experiment to obtain optical data for an unsteady, under-expanded axisymmetric jet issuing from a one inch diameter tube at supersonic velocity. A technique is described which has been found useful to obtain sequence photographic data for such transient processes. In this technique, a bleachable absorber is used to generate multiple laser pulses so that instantaneous images of the laser-illuminated event are swept onto a fixed film drum with a mirror rotating at approximately 16.2 mm/microsecond. (Comments on our experience with high voltage double-pulsing a Pockels cell are also included). Sequence (multiple frame) laser interferograms made by backlighting a Mach-Zehnder optical interferometer used to observe the flow are shown and discussed. Single frame spark shadow photographs which give qualitative support to the interferograms are also shown. Author (GRA)

N74-19929# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDY OF GAS DISTRIBUTING UNIT OF CALCINING SHAFT FURNACE ON AERODYNAMIC MODEL
K. V. Malikov 11 Dec. 1973 13 p refs Transl. into ENGLISH from Sb. Nauch. Tr. Vses. Nauch.-Issled. Inst. Met. Teplotekh. (USSR), no. 23, 1970 p 304-309
(AF Proj. G101)
(AD-773271; FTD-HT-23-368-74) Avail: NTIS CSCL 13/1
The data which were obtained in experiments using the aerodynamic model enabled the authors to explain hydraulic interrelationships in the studied furnace variation. These data also make it possible to judge the magnitude of resistance coefficients on individual sections of the unit and can be used in calculating similar designs. GRA

N74-19930# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
BASIC INSTABILITY MECHANISMS IN CHEMICALLY REACTING SUBSONIC AND SUPERSONIC FLOWS Final Scientific Report
T.-Y. Toong Nov. 1973 45 p refs
(Contract F44620-69-C-0016; AF Proj. 9711)
(AD-773317; AFOSR-74-0065TR) Avail: NTIS CSCL 21/2
The report summarizes the main results and conclusions obtained during the contract period in two studies, both aimed at understanding the instability mechanisms in reacting flows. In one study, both theoretical and experimental work is conducted to determine the fluid-dynamic and chemical-kinetic mechanisms by which instabilities are triggered in flows around spherical, cylindrical and conical projectiles fired at supersonic speeds into reactive gaseous media as well as their effects on heat-release rates and approach to chemical equilibrium in the shock layer and inviscid wake. (Modified author abstract) GRA

N74-20417 Pratt and Whitney Aircraft, East Hartford, Conn.
V/STOL DEFLECTOR DUCT PROFILE STUDY
R. I. Strough and T. A. Wynosky *In* AGARD V/STOL Propulsion Systems Jan. 1974 13 p (For availability see N74-20401 11-28)

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N74-19931 Pennsylvania Univ., Philadelphia.
A COST/PERFORMANCE ANALYSIS OF AIRCRAFT AND SATELLITES USED AS EARTH RESOURCES SURVEY VEHICLES Ph.D. Thesis
Charles Edward Cheeseman, Jr. 1973 171 p
Avail: Univ. Microfilms Order No. 74-2396
The problem of designing, in a generalized manner, a data collection system to conduct earth resources surveys is examined. Systematic modelling of the essential performance and economic characteristics of an aircraft-satellite system for such a purpose is introduced. The modelling process involves: (1) the generation of a set of variables which could be used to specify user information requirements in terms meaningful to the designer, (2) the derivation of spatial and temporal relationships which permit the transformation of the user requirements into unit cost elements, and (3) the development of cost information for various fixed and operating costs. Dissert. Abstr.

N74-19932 Department of Scientific and Industrial Research, Wellington (New Zealand). Geophysics Div.
THE GEOMAGNETIC FIELD IN NEW ZEALAND AT EPOCH 1970.5
W. I. Reilly and A. L. Burrows (Phys. and Eng. Lab., Christchurch, N. Z.) 1973 104 p refs
(Bull-211; Geophysical-Memoir-8) Copyright. Avail: Issuing Activity
Observations of the magnetic vector between 1940 and 1970 have been used in the least-squares determination of the geomagnetic normal field for the New Zealand region, expressed as an analytic function of geographic coordinates and time involving 26 coefficients. The results are given in the form of contour maps of the seven normal field elements at epoch 1970.5, the maps covering an area from 33 deg to 53 deg S latitude, and 165 deg to 185 deg E longitude. Also given are the values of the 26 numerical coefficients in the expression for the normal field, and the values of the observed and residual magnetic vector for each observation. Mean station residuals for each element are shown on the contour maps. A comparison of the present normal field charts with those of earlier epochs shows that the new method of analysis had produced significant changes only in the representation of the easterly force (Y) and declination (D) in the North Island, and this is due to adoption of a criterion of consistency between X and Y (or D and H). A further comparison between the present normal field and that predicted from the parameters of the International Geomagnetic Reference Field 1965.0 shows such discrepancies as to suggest that the latter does not give an adequate representation of the geomagnetic field in the New Zealand region. Author

N74-19933 Ohio State Univ., Columbus.
AERODIST CONTROLLED PHOTOGRAPHY FOR TOPOGRAPHIC MAPPING Ph.D. Thesis
Rae Alden Stewart 1973 306 p
Avail: Univ. Microfilms Order No. 74-3325
The Aerodist controlled photography system, which provides the supplementary survey control densification required for topographic mapping was tested. It was proven that the Aerodist controlled photography system is more than adequate for the provision of auxiliary planimetric control for Class A topographic mapping at the scale of 1/50,000 (NATO specifications). It was also shown that such auxiliary control satisfies the requirements for Class B mapping at the scale of 1/25,000. Furthermore, the results strongly indicate that, with the realization of suggested improvements in the calibration of the exposure - ranging delay time, plus an optimum choice of aerial camera and flying height, the system is capable of providing the required planimetric accuracy for Class A mapping at the scale of 1/25,000.
Dissert. Abstr.

N74-19934 Oklahoma Univ., Norman.
UNSUPERVISED SPATIAL CLUSTERING WITH SPECTRAL DISCRIMINATION Ph.D. Thesis
Robert Rhea Jayroe, Jr. 1973 123 p
Avail: Univ. Microfilms Order No. 73-23943

The development of a computer program for extracting features from remotely sensed data presented in digital image form is presented. This computer program requires no human supervision or prejudgement and operates unassisted on the raw digital data. The presentation of this work includes a condensed general background on remote sensing of earth features, and a short synopsis on some of the most commonly used types of feature extraction techniques. A presentation of results obtained from the unsupervised feature extraction computer program along with description and listing of the computer program is also presented. Dissert. Abstr.

N74-19935 Ohio State Univ., Columbus.
INDEPENDENT MODEL AERIAL TRIANGULATION-REFINEMENTS AND ERROR STUDIES Ph.D. Thesis
Aldwyn Thomas Philip 1973 174 p
Avail: Univ. Microfilms Order No. 74-3289

Refinements which can be conveniently applied to independent model aerial triangulation are considered. Error studies, both theoretical and empirical are also attempted. The main thrust is towards upgrading the semi-analytical approach, but attention is also paid to the other two approaches. Fairly detailed descriptions are given of all three approaches. Then the sources contributing to error are considered, and suitable corrections and refinements are reviewed and proposed. The use of airborne recorded auxiliary data in independent model triangulation is discussed. A new technique for simultaneously refining the model and perspective center coordinates of semi-analytical triangulation is postulated, and initial testing performed. The scheme appears promising. The correction scheme incorporates a simple and novel method of simultaneously determining the coordinates of the perspective centers under the working conditions of the tilts imposed by relative orientation. Dissert. Abstr.

N74-19936 Washington Univ., Seattle.
A GENERALIZED THREE-DIMENSIONAL MIXING LENGTH MODEL APPLIED TO TURBULENT TRANSFER IN THE ATMOSPHERIC SURFACE LAYER Ph.D. Thesis
Abram Bernard Bernstein 1973 148 p
Avail: Univ. Microfilms Order No. 74-2198

Observations in the atmospheric surface layer indicate that in steady horizontally uniform conditions turbulent flux vectors are not directed vertically but have a marked longitudinal component. An extension of the classical mixing length concept is developed which takes into account the three-dimensional nature of fluxes and gradients and the possibility that transferred properties may not be fully conserved. This model leads to equations which are consistent with experimental evidence, and which specify that while the lateral flux component in a unidirectional shear flow is linearly related to the lateral component of the gradient, the flux-gradient relations in the longitudinal and vertical directions are non-linear. Nonlinearity in the longitudinal direction persists even in horizontally uniform conditions, and estimates are made of the coefficients appearing in the equations under such conditions. Dissert. Abstr.

N74-19937 Cincinnati Univ., Ohio.
DYNAMICS OF THE WINTER POLAR UPPER ATMOSPHERE: UNIVERSAL TIME DEPENDENCE OF THE ELECTRON DENSITY AND THE PEAK OF THE F-LAYER Ph.D. Thesis
Demetrios J. Moschandreas 1973 128 p
Avail: Univ. Microfilms Order No. 74-1698

The effect of incident electron flux on the behavior of the winter polar ionosphere is investigated by using Green's function and integral equations. The treatment assumes a one dimensional model and includes diffusion, recombination and production from electron flux. The analytical approach formulated is general and the disturbance function used can vary from production mechanism to photoionization, particle precipitation, thermospheric winds or passage of gravity waves. The integral equation approach, as opposed to the time-dependent partial differential equation subject to certain boundary conditions, broadens the scope of the investigation and gives simple analytic approximations which provide immediate physical pictures. The degradation of energy of primary soft electrons is investigated from a semi-empirical point of view. The concept of pitch-angle distribution of low energy incoming electrons is developed, and the oblique incidence of the precipitating fluxes is closely examined. Dissert. Abstr.

N74-19938*# Iowa Univ., Iowa City.
UTILIZING ERTS-1 IMAGERY FOR TECTONIC ANALYSIS THROUGH STUDY OF THE BIGHORN MOUNTAINS REGION Progress Report, 16 Sep. 1973 - 15 Mar. 1974
Richard A. Hoppin, Principal Investigator 15 Mar. 1974 1 p ERTS
(Contract NAS5-21852)
(E74-10395; NASA-CR-137213) Avail: NTIS HC $4.00 CSCL 08F

There are no author-identified significant results in this report.

N74-19939*# Stanford Research Inst., Menlo Park, Calif.
STUDY OF TIME LAPSE PROCESSING FOR DYNAMIC HYDROLOGIC CONDITIONS Progress Report, 6 Sep. 1973 - 6 Mar. 1974
Sidney M. Serebreny, Principal Investigator 16 Mar. 1974 17 p ERTS
(Contract NAS5-21841)
(E74-10403; NASA-CR-137237) Avail: NTIS HC $4.00 CSCL 08H

There are no author-identified significant results in this report.

N74-19940*# Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif. 02f
INVENTORY OF FOREST AND RANGELAND AND DETECTION OF FOREST STRESS Progress Report, 1 Jan. - 28 Feb. 1974
Robert C. Heller, Robert C. Aldrich, Richard S. Driscoll, and F. P. Weber, Principal Investigators 20 Mar. 1974 14 p ERTS (NASA Order S-70251-AG)
(E74-10404; NASA-CR-137232; FS-I-7) Avail: NTIS HC $4.00

The author has identified the following significant results. Controlled visual interpretation of one ERTS-1 scene taken at the peak of the growing season has indicated that classification to the ECOCLASS Series level is not entirely satisfactory. For five forest classes, aspen, Douglas-fir, lodgepole pine, ponderosa pine, and Spruce/fir, correct identification ranged from 60 to 70 percent. With the exception of shortgrass and wet shrubby meadow classes in the nonforest categories (81 and 100 percent correct, respectively), correct identification of the nonforest classes is so far unacceptable. The low accuracies are believed due to: (1) edge effects due to ecotones between plant community classes with apparent similar image characteristics; (2) confounding effects of amount of plant crown cover and ground surface material in the scene; and (3) variable land slope degree and aspect as it affects the image signature.

N74-19941*# Geological Survey, Washington, D.C.
EVALUATION OF ERTS-1 DATA APPLICATIONS TO GEOLOGIC MAPPING, STRUCTURAL ANALYSIS AND MINERAL RESOURCE INVENTORY OF SOUTH AMERICA WITH SPECIAL EMPHASIS ON THE ANDES MOUNTAIN REGION Progress Report, 1 May - 30 Jun. 1973
William D. Carter, Principal Investigator 28 Sep. 1973 3 p Sponsored by NASA ERTS
(E74-10405; NASA-CR-137247) Avail: NTIS HC $4.00 CSCL 08F

The author has identified the following significant results. Segerstrom delineated many grabens (down-faulted blocks) not shown on published maps of Argentina nor of South America. The faults that border the grabens are better appreciated in ERTS-1 imagery than on air photos or on the ground because of the masking affect of alluvial fill deposits. In frame no. 1188-13545 a change in local prevailing wind direction from east to southeast is noted in sand streams. In frame no. 1188-13551 it was surprising to see that Solar del Hombre Muerto was covered with water. In November 1971 the investigator has driven across the salt pan several times without

wetting his wheels. It was also possible to differentiate the following rock and soil classes: Granites, metamorphic, volcanic rocks, Tertiary and Quaternary clastic deposits and salt pans. Portions of railroads and highways as well as small towns were identified. In frame no. 1188-13551 the Incahuasi Gold Mine and the Tincalayu Borax Mine were located.

N74-19942*# Texas Technological Univ., Lubbock. Remote Sensing Lab.
DYNAMICS OF PLAYA LAKES IN THE TEXAS HIGH PLAINS Progress Report, Oct. 1973 - Mar. 1974
C. C. Reeves, Jr., Principal Investigator 31 Mar. 1974 7 p
(Contract NAS5-21720)
(E74-10406; NASA-CR-137252) Avail: NTIS ERTS CSCL 08H

There are no author-identified significant results in this report.

N74-19943*# Cornell Univ., Ithaca, N.Y. Div. of Atmospheric Sciences.
PHENOLOGY SATELLITE EXPERIMENT Progress Report, Aug. 1973 - Feb. 1974
Bernard E. Dethier, Principal Investigator, Marshall D. Ashley (Maine Univ.), Byron O. Blair (Purdue Univ.), Joseph M. Caprio (Montana State Univ.), Richard J. Hopp (Vermont Univ.), and John W. Rouse, Jr. (Texas A&M Univ.) 15 Mar. 1974 32 p refs ERTS
(Contract NAS5-21781)
(E74-10407; NASA-CR-137253) Avail: NTIS HC $4.75 CSCL 08F

There are no author-identified significant results in this report.

N74-19944*# Rockwell International Science Center, Thousand Oaks, Calif.
IDENTIFICATION AND INTERPRETATION OF TECTONIC FEATURES FROM ERTS-1 IMAGERY Progress Report, 1 Feb. - 31 Mar. 1974
Monem Abdel-Gawad, Principal Investigator 4 Apr. 1974 3 p ERTS
(Contract NAS5-21767)
(E74-10409; NASA-CR-137254; SC543.11PR) Avail: NTIS HC $4.00 CSCL 08G

The author has identified the following significant results. ERTS-1 imagery shows that the southern segment of the San Gabriel fault which controls the west fork of the San Gabriel River is strikingly similar to the Mill Creek Fault in the San Bernardino Mountains. It has also been noted that there is a similarity between the Sierra Madre thrust zone of the San Gabriel Mountains to the Banning thrust of the San Bernardino Mountains. This suggests that the southern San Gabriel fault was once continuous with the Mill Creek fault. When the San Bernardino Mountain block is theoretically moved to the northwest along the San Jacinto fault so that the Mill Creek fault is aligned with the southern part of the San Gabriel fault, it was found that the four transverse fault segments become aligned with the Pinto Fault on the east and with the Raymond-Santa Monica Malibu Fault zone on the west. The reconstruction identifies a continuous zone of transverse faulting extending from the Colorado River Desert to the Pacific. It seems likely that the entire fault zone was once a continuous left-lateral shear. This Anacapa Shear has probably been subjected to a 50 km left lateral movement. This analysis strongly indicates that the tectonic history of the Transverse Range has been characterized by left lateral shear on transverse faults and right lateral shear on the San Andreas fault system.

N74-19945*# Argus Exploration Co., Los Angeles, Calif.
INVESTIGATION OF A LINEAMENT EXPRESSED IN AN OBLIQUE APOLLO 9 PHOTOGRAPH
Mark A. Liggett, Principal Investigator and Jack W. Barth Mar. 1974 9 p refs ERTS
(Contract NAS5-21809)
(E74-10410; NASA-CR-137255) Avail: NTIS HC $4.00 CSCL 14E

The author has identified the following significant results. A linear topographic feature, referred to as the New York Mountains lineament, was recognized in an oblique Apollo 9 photograph to extend from the Providence Mountains of California to near Lake Mead, Arizona. In subsequent vertical ERTS-1 imagery this feature was found to have vague and indistinct expression. A study was conducted to determine the possible geologic origin(s) of the lineament and to explain its anomalous expression in the Apollo 9 photograph. The results suggest that the apparent expression of the lineament is due to a combination of the oblique view of the Apollo photograph, low sun angle illumination of southeast facing slopes, shadowing of northwest facing slopes, and linear snow line along the southeastern flank of the New York Mountains. No geologic or structural causes for the lineament have been found.

N74-19946*# Argus Exploration Co., Los Angeles, Calif.
CRUSTAL EXTENSION AND TRANSFORM FAULTING IN THE SOUTHERN BASIN RANGE PROVINCE
Mark A. Liggett, Principal Investigator and John F. Childs Mar. 1974 54 p refs ERTS
(Contract NAS5-21809)
(E74-10411; NASA-CR-137256) Avail: NTIS HC $5.75 CSCL 08G

The author has identified the following significant results. Field reconnaissance and study of geologic literature guided by analysis of ERTS-1 MSS imagery have led to a hypothesis of tectonic control of Miocene volcanism, plutonism, and related mineralization in part of the Basin Range Province of southern Nevada and northwestern Arizona. The easterly trending right-lateral Las Vegas Shear Zone separates two volcanic provinces believed to represent areas of major east-west crustal extension. One volcanic province is aligned along the Colorado River south of the eastern termination of the Las Vegas Shear Zone; the second province is located north of the western termination of the shear zone in southern Nye County, Nevada. Geochronologic, geophysical, and structural evidence suggests that the Las Vegas Shear Zone may have formed in response to crustal extension in the two volcanic provinces in a manner similar to the formation of a ridge-ridge transform fault, as recognized in ocean floor tectonics.

N74-19947*# Geological Survey, Reston, Va.
SATELLITE GEOLOGICAL AND GEOPHYSICAL REMOTE SENSING OF ICELAND Progress Report, 1 Nov. - 31 Dec. 1973
Richard S. Williams, Jr., Principal Investigator 1 Jan. 1974 10 p refs Sponsored by NASA ERTS
(E74-10412; NASA-CR-137271) Avail: NTIS HC $4.00 CSCL 08G

The author has identified the following significant results. The seasonal change in size of sediment plumes from the many glacial rivers which discharge into the sea along the south coast gives an indication of seasonal changes in melting rates of glaciers. Changes in area of lakes, particularly glacier-margin lakes can be mapped of most of the area covered by glacial ice in Iceland. Recently deglaciated terrain can be distinguished on MSS color composites. The increase in surface area of the ice-dammed lake, Graenalon, was monitored until the occurrence of a jokulhlaup, after which the surface area of the lake was considerably reduced. The effect of two subglacial jokulhlaups on the overlying ice cover can be seen in the form of collapse features in the surface of Vatnajokull. MSS color composites permit the mapping of five distinct vegetation types; forests, cultivated areas, grasslands, reclaimed areas, and lichen-covered bedrock. Features as small as 100 m can be discerned. The ability to map landforms, vegetation distribution, occurrence of snowcover, glaciers, and geologic structure stereoscopically permits a much greater accurate analysis of these features.

N74-19948*# Geological Survey, Reston, Va. Water Resources Div.
DYNAMICS OF SUSPENDED SEDIMENT PLUMES IN LAKE ONTARIO Progress Report, 1 Jan. - 28 Feb. 1974
Edward J. Pluhowski, Principal Investigator 1 Mar. 1974 3 p ERTS
(NASA Order S-70243-AG-2)
(E74-10413; NASA-CR-137272) Avail: NTIS HC $4.00 CSCL 08H

The author has identified the following significant results. Imagery obtained on 25 January 1974, shows a well-defined

plume at the mouth of the Niagara River and a much smaller but intense plume emanating from Port Dalhousie Harbor, Ontario. Additionally, a plume can be seen trailing eastward from the outer end of the Welland Canal. This is the first time that a clear-cut winter view of these plumes was detected by the ERTS-1 satellite outside the navigation season. Since the Welland Canal was not in operation, it is likely that the plume, visible along the canal's outer jetty on frames 1551-15313-4-5, was the result of wastward moving turbid water emanating from Port Dalhousie Habor to the west.

N74-19949*# Bureau of Sport Fisheries and Wildlife, Jamestown, N.D. Northern Prairie Wildlife Research Center.
APPRAISING CHANGES IN CONTINENTAL MIGRATORY BIRD HABITAT Progress Report, 1 Jan. - 28 Feb. 1974
Harvey K. Nelson, Principal Investigator 1 Mar. 1974 3 p ERTS
(NASA Order S-70243-AG-4)
(E74-10414; NASA-CR-137273) Avail: NTIS HC $4.00 CSCL 06C

There are no author-identified significant results in this report.

N74-19950*# Geological Survey, Reston, Va.
THE UTILIZATION OF ERTS-1-GENERATED PHOTOGRAPHS IN THE EVALUATION OF THE IRANIAN PLAYAS AS POTENTIAL LOCATIONS FOR ECONOMIC AND ENGINEERING DEVELOPMENT Progress Report, 1 Jan. - 28 Feb. 1874
Daniel B. Krinsley, Principal Investigator 7 Mar. 1974 3 p ref ERTS
(NASA Order S-70243-AG-3)
(E74-10415; NASA-CR-137274) Avail: NTIS HC $4.00 CSCL 08H

The author has identified the following significant results. Seasonal monitoring of hydrologic conditions at three playa lakes provides a basis for constructing an annual water inventory for these lakes. Although the extreme variation in the extent of playa lakes must be considered, the principial periods of their fluctuations are generally constant. Playa lakes provide an important water source for arid region needs, and their water can be diverted and stored for use during the long, hot, and dry summer. At their 1973 maxima, approximately 400 million cu m and 794 million cu m of water were available at the lakes at Qom and Neriz playas, respectively. These lakes adjoin areas of moderately dense population that have severe annual water deficits. A preliminary road alignment across the Great Kavir in north-central Iran has been prepared from an analysis of ERTS-1 images of that area from September 2, 1972, through May 12, 1973, a total of 6 scenes. An all-weather road constructed along this alignment could reduce the distance between points north and south of the Great Kavir by as much as 700 km.

N74-19951*# Geological Survey, Reston, Va. Geographic Applications Program.
CENSUS CITIES EXPERIMENT IN URBAN CHANGE DETECTION Progress Report, 1 Jul. - 31 Dec. 1973
James R. Wray, Principal Investigator and Valerie A. Milazzo 1 Mar. 1974 7 p ERTS
(NASA Order S-70243-AG-2)
(E74-10417; NASA-CR-137276) Avail: NTIS HC $4.00 CSCL 08B

The author has identified the following significant results. Mapping of 1970 and 1972 land use from high-flight photography has been completed for all test sites: San Francisco, Washington, Phoenix, Tucson, Boston, New Haven, Cedar Rapids, and Pontiac. Area analysis of 1970 and 1972 land use has been completed for each of the mandatory urban areas. All 44 sections of the 1970 land use maps of the San Francisco test site have been officially released through USGS Open File at 1:62,500. Five thousand copies of the Washington one-sheet color 1970 land use map, census tract map, and point line identification map are being printed by USGS Publication Division. ERTS-1 imagery for each of the eight test sites is being received and analyzed. Color infrared photo enlargements at 1:100,000 of ERTS-1 MSS images of Phoenix taken on October 16, 1972 and May 2, 1973 are being analyzed to determine to what level land use and land use changes can be identified and to what extent the ERTS-1 imagery can be used in updating the 1970 aircraft photo-derived land use data base. Work is proceeding on the analysis of ERTS-1 imagery by computer manipulation of ERTS-1 MSS data in digital format. ERTS-1 CCT maps at 1:24,000 are being analyzed for two dates over Washington and Phoenix. Anniversary tape sets have been received at Purdue LARS for some additional urban test sites.

N74-19952*# Geological Survey, Denver, Colo.
THERMAL SURVEILLANCE OF ACTIVE VOLCANOES Progress Report, 1 Jul. 1973 - 1 Jan. 1974
Jules D. Friedman, Principal Investigator 1 Jan. 1974 6 p ref ERTS
(NASA Order S-70243-AG)
(E74-10418; NASA-CR-137277) Avail: NTIS HC $4.00 CSCL 08F

The author has identified the following significant results. By the end of 1973, aerial infrared scanner traverses for thermal anomaly recordings of all Cascade Range volcanoes were essentially completed. Amplitude level slices of the Mount Baker anomalies were completed and compiled at a scale of 1:24,000, thus producing, for the first time, an accurate map of the distribution and intensity of thermal activity on Mount Baker. The major thermal activity is concentrated within the crater south of the main summit and although it is characterized by intensive solfataric activity and warm ground, it is largely subglacial, causing the development of sizable glacier perforation features. The outgoing radiative flux from the east breach anomalies is sufficient to account for the volume of ice melted to form the glacier perforations. DCP station 6251 has been monitoring a thermally anomalous area on the north slope of Mount Baker. The present thermal activity of Mount Baker accounts for continuing hydrothermal alteration in the crater south of the main summit and recurrent debris avalanches from Sherman Peak on its south rim. The infrared anomalies mapped as part of the experiment SR 251 are considered the basic evidence of the subglacial heating which was the probable triggering mechanism of an avalanche down Boulder Glacier on August 20-21, 1973.

N74-19953*# Environmental Research Inst. of Michigan, Ann Arbor.
MAPPING EXPOSED SILICATE ROCK TYPES AND EXPOSED FERRIC AND FERROUS COMPOUNDS FROM A SPACE PLATFORM Quarterly Report, 8 Sep. - 8 Dec. 1973
Robert K. Vincent, Principal Investigator 5 Apr. 1974 2 p EREP
(Contract NAS9-13317)
(E74-10419; NASA-CR-137278; ERIM-102000-18-L) Avail: NTIS HC $4.00 CSCL 08G

There are no author-identified significant results in this report.

N74-19954*# Earth Satellite Corp., Berkeley, Calif.
PLAN FOR THE UNIFORM MAPPING OF EARTH RESOURCES AND ENVIRONMENTAL COMPLEXES FROM SKYLAB IMAGERY Monthly Plans and Progress Report, 1-31 Mar. 1974
Charles E. Poulton, Principal Investigator 31 Mar. 1974 15 p EREP
(Contract NAS9-13286)
(E74-10420; NASA-CR-137279; MPR-14) Avail: NTIS HC $4.00 CSCL 08B

There are no author-identified significant results in this report.

N74-19955*# Nevada Univ., Reno. Mackay School of Mines.
THE GREAT BASIN INVESTIGATION Monthly Progress Report, Mar. 1974
Jack G. Quade, Principal Investigator Mar. 1974 3 p EREP (Contract NAS9-13274)
(E74-10421; NASA-CR-137280) Avail: NTIS HC $4.00 CSCL 08E

There are no author-identified significant results in this report.

N74-19956*# Wolf Research and Development Corp., Riverdale, Md.

THE INTERDEPENDENCE OF LAKE ICE AND CLIMATE IN CENTRAL NORTH AMERICA Progress Report, Feb. - Mar. 1974
Allan Jelacic, Principal Investigator 10 Apr. 1974 6 p refs ERTS
(Contract NAS5-21761)
(E74-10422; NASA-CR-137281; PR-8) Avail: NTIS HC $4.00 CSCL 08L

There are no author-identified significant results in this report.

N74-19957*# Ecosystems International, Inc., Gambrills, Md.
SYNTHESES AND ANALYSES OF EARTH RESOURCES TECHNOLOGY SATELLITE (ERTS) PROGRAM DATA Quarterly Informal Progress Report
Peter A. Castruccio 5 Apr. 1974 37 p ERTS
(Contract NASw-2488)
(E74-10427; NASA-CR-137353) Avail: NTIS HC $5.00 CSCL 02C

There are no author-identified significant results in this report.

N74-19958*# Colorado School of Mines, Golden. Dept. of Geology.
APPLICATION OF REMOTE SENSOR DATA TO GEOLOGIC ANALYSIS OF THE BONANZA TEST SITE COLORADO Semiannual Progress Report, 1 Apr. - 30 Sep. 1973
Keenan Lee, Comp., R. W. Butler, J. C. Fisher, D. Huntley, R. L. Hulstrom, D. H. Knepper, J. R. Muhm, D. L. Sawatzky, K. E. Worman, and D. Wychgram Oct. 1973 48 p refs
(Grant NGL-06-001-015)
(NASA-CR-137363; Rept-73-4) Avail: NTIS HC $5.50 CSCL 08G

Research activities on geologic remote sensing applications for Colorado are summarized. Projects include: regional and detailed geologic mapping, surficial and engineering geology, fracture studies, uranium exploration, hydrology, and data reduction and enhancement. The acquisition of remote sensor data is also discussed. K.M.M.

N74-19959*# Alabama A & M Univ., Normal. Dept. of Natural Resources.
APPLICATION OF REMOTE SENSING IN AGRICULTURE AND FORESTRY AND GROUND TRUTH DOCUMENTATION IN RESOURCE PLANNING Final Technical Report, May 1971 - May 1974
4 Jan. 1974 7 p
(Grant NGR-01-001-014)
(NASA-CR-138028) Avail: NTIS HC $4.00 CSCL 08B

Varied small scale imagery was used for detecting and assessing damage by the southern pine beetle. The usefulness of ERTS scanner imagery for vegetation classification and pine beetle damage detection and assessment is evaluated. Ground truth acquisition for forest identification using multispectral aerial photographs is reviewed. J.A.M.

N74-19960*# Scripta Technica, Inc., Washington, D.C.
THE BERING EXPERIMENT
NASA Nov. 1973 162 p refs Transl. into ENGLISH of "Eksperiment Bering" Leningrad, USSR Hydrometeorol. Serv., A. I. Voyeykov Main Geophys. Obs. 186 p
(Contract NASw-2484)
(NASA-TT-F-14772) Avail: NTIS HC $11.25 CSCL 04A

Data are presented which were collected by the Soviet party to the Soviet-American project on microwave measurement of ice cover, sea state and precipitation in Bering Sea, February 15 to March 7, 1973. Author

N74-19961*# Scientific Translation Service, Santa Barbara, Calif.
DETERMINATION OF THE SHAPE OF THE EARTH'S PHYSICAL SURFACE FROM THE ANOMALIES OF THE VERTICAL GRADIENT OF GRAVITATIONAL ACCELERATION
S. V. Gromov Washington NASA Apr. 1974 19 p refs Transl. into ENGLISH from Geodez. i Kartograf. (Moscow), no. 16, 1972 p 26-34
(Contract NASw-2483)
(NASA-TT-F-15426) Avail: NTIS HC $4.00 CSCL 08E

The anomaly of the vertical gradient of gravitational acceleration is used to determine the shape of the physical surface of the earth. The boundary condition for the perturbing potential and the basic integral equations are derived. A calculation is made of the correction factor in the basic boundary condition. Author

N74-19962# Joint Publications Research Service, Arlington, Va.
SEA SURFACE ENERGY AND TEMPERATURE ANALYSIS
21 Mar. 1974 12 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Fiz. Atmosfery i Okeana (Moscow), v. 9, no. 12, 1973 7 p
(JPRS-61542) Avail: NTIS HC $4.00

Reduction of sky radiation effects during water surface temperature measurement with radiation thermometer is discussed. The energy carrying part of the sea wave spectrum is determined, according to the phase characteristics of a radio signal scattered by the sea. For individual titles, see N74-19963 through N74-19964.

N74-19963 Joint Publications Research Service, Arlington, Va.
REDUCING THE EFFECT OF SKY RADIATION DURING MEASUREMENT OF WATER SURFACE TEMPERATURE WITH RADIATION THERMOMETER
I. T. Razumovskiy *In its* Sea Surface Energy and Temp. Analysis (JPRS-61542) 21 Mar. 1974 p 1-3 refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Fiz. Atmosfery i Okeana (Moscow), v. 9, no. 12, 1973 p 1318-1320 (For availability see N74-19962 11-13)

To reduce radiating action, a measuring method was tested based on temperature determination of surface water according to its emission, polarized in the plane of incidence and aimed into the radiation thermometer at the Brewster angle (54 deg). Water radiation temperature as a function of the sighting angle is presented for a clear sky and a cloudy sky, including variations with polarized and unpolarized radiation. This method was found to be effective when the sighting axis fluctuates in the radiometer and during background radiation variations. J.A.M.

N74-19964 Joint Publications Research Service, Arlington, Va.
DETERMINING THE ENERGY-CARRYING PART OF THE SEA WAVE SPECTRUM ACCORDING TO THE PHASE CHARACTERISTICS OF A RADIO SIGNAL SCATTERED BY THE SEA
A. D. Rozenberg, I. Ye. Ostrovskiy, V. I. Zeldis, I. A. Leykin, and V. G. Ruskevich *In its* Sea Surface Energy and Temp. Analysis (JPRS-61542) 21 Mar. 1974 p 1323-1326 refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Fiz. Atmosfery i Okeana (Moscow), v. 9, no. 12, 1973 p 1323-1326 (For availability see N74-19962 11-13)

Signals that are mirror reflected by the sea surface are examined, including radar signals for irradiating the sea at small flashout angles. The phase characteristics of sea scattered signals are used to gather data about sea wave parameters. J.A.M.

N74-19965*# Goodyear Aerospace Corp., Akron, Ohio.
ADVANCED DEFINITION STUDY FOR THE DETERMINATION OF ATMOSPHERIC OZONE USING THE SATELLITE ECLIPSE TECHNIQUE Final Report
R. Emmons, R. J. Preski, F. H. Kierstead, Jr., F. C. Doll, D. T. Wight, and D. C. Romick 26 Nov. 1973 136 p refs
(Contract NAS1-12685)
(NASA-CR-132405; GER-16042) Avail: NTIS HC $10.00 CSCL 04A

A study was made to evaluate the potential for remote ground-based measurement of upper atmospheric ozone by determining the absorption ratio of selected narrow bands of sunlight as reflected by satellites while passing into eclipse, using the NASA Mobile Satellite Photometric Observatory (MOSPO). Equipment modifications to provide optimum performance were analyzed and recommendations were made for improvements to the system to accomplish this. These included new sensor tubes, pulse counting detection circuitry, filters, beam splitters and associated optical revision, along with an automatic tracking capability plus corresponding operational techniques which should

extend the overall measurement capability to include use of satellites down to 5th magnitude. Author

N74-19966*# Techtran Corp., Glen Burnie, Md.
DETERMINATION OF PHYSICAL CHARACTERISTICS OF SURFACE SOIL LAYER ACCORDING TO RADIO THERMAL EMISSION
K. Ya. Kondratyev Washington NASA Mar. 1974 10 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 208, no. 2, 1973 p 342-345
(Contract NASw-2485)
(NASA-TT-F-14761) Avail: NTIS HC $4.00 CSCL 08M

The physical characteristics of various soils on the basis of radio thermal emission is determined. Conclusions are made on the basis of numerical experiments for real temperature and humidity profiles. Radio brightness temperature is a function of surface temperature and emissivity of soil. It is possible to determine the temperature profile constant at great depths and the surface temperature gradient. The effects of foam and organic films on the radio emission of the ocean surface are discussed. Author

N74-19967*# Techtran Corp., Glen Burnie, Md.
SPACE ECOLOGY (BASED ON MATERIALS OF 22D INTERNATIONAL CONGRESS ON ASTRONAUTICS
K. Ya. Kondratyev Washington NASA Mar. 1974 14 p refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 5, 1972 p 108-113
(Contract NASw-2485)
(NASA-TT-F-14760) Avail: NTIS HC $4.00 CSCL 08F

Reports on the problem of utilization of satellites for studying natural resources of the earth, presented at the 22nd International Congress on Astronautics, are reviewed. Author

N74-19968*# Techtran Corp., Glen Burnie, Md.
DETERMINATION OF CERTAIN CHARACTERISTICS OF SOIL ACCORDING TO MICROWAVE RADIATION DATA
K. Ya. Kondratyev and Ye M. Shulgina Washington NASA Mar. 1974 8 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 200, no. 1, 1971 p 88-90
(Contract NASw-2485)
(NASA-TT-F-14762) Avail: NTIS HC $4.00 CSCL 08M

A method is described for determining soil humidity, surface temperature gradient, surface reflection coefficient and exponential temperature profile factor on the basis of the measured amplitudes of the zero and first harmonics of the radio brightness temperature. Author

N74-19969*# Kanner (Leo) Associates, Redwood City, Calif.
ADVANCED RESULTS OF THE FIRST EXPEDITION AFTER A PROGRAM OF COMPLEX ENERGY EXPERIMENTS (KENEX-70)
K. Ya. Kondratyev, B. F. Belov, O. B. Vasilev, L. S. Ivlev, S. P. MalevskiyMalevich, L. R. Orlenko, O. I. Popov, Yu. I. Rabinovich, N. E. Ter-MarkaryaN, and L. I. Chapurskiy Washington NASA Mar. 1974 18 p refs Transl. into ENGLISH from Byull. VMO (USSR), v. 20, no. 3, 1971 p 1-11
(Contract NASw-2481)
(NASA-TT-F-14765) Avail: NTIS HC $4.00 CSCL 04A

Results are presented of the first expedition of the Kenex program, carried out in the desert regions of Central Asia. The main aim of the expedition was to carry out research into the ground layer and free atmosphere. However, other subjects investigated were the energy effects on the underlying surface and heat flows in the atmosphere. Aircraft and helicopters carried out measurements and readings of spectral and integral radiation flows and temperature, moisture and aerosol profiles. Observations made by a ground party at Repetek were directed at wind speeds, moisture, temperature gradients in the 15-m layer and radiation flows at other levels. Tables show the results obtained at this stage. Author

N74-19970*# Kanner (Leo) Associates, Redwood City, Calif.
REMOTE DETECTION OF POLLUTION OF WATER RESERVOIRS AND PHYTOPLANKTON BY OPTICAL METHODS
K. Ya. Kondratyev, A. A. Buznikov, and D. V. Pozdnyakov Washington NASA Mar. 1974 20 p refs Transl. into ENGLISH from Vod. Resur. (USSR), no. 3, 1972 p 65-74
(Contract NASw-2481)
(NASA-TT-F-14767) Avail: NTIS HC $4.00 CSCL 08H

Remote detection of polluted water surfaces and phytoplankton by optical methods is described. Spectral characteristics obtained by spaceborne photography and infrared spectroscopy are compared with the spectral properties of unpolluted water surfaces. Oil slicks were detected by the change of thermodynamic equilibrium of the water surface. Comparisons are made between the spectral characteristics of oil and chlorophylls. The increased production of phytoplankton due to the release of chemically active wastes, such as nitrogen compounds, is also described. S.K.W.

N74-19971*# Kanner (Leo) Associates, Redwood City, Calif.
COSMIC DISTANCE INDICATION OF THE NATURAL ENVIRONMENT
K. Ya. Kondratyev Washington NASA Mar. 1974 13 p refs Transl. into ENGLISH from Vestn. Akad. Nauk SSSR (Moscow), v. 10, 1972 p 41-46
(Contract NASw-2481)
(NASA-TT-F-14766) Avail: NTIS HC $4.00 CSCL 08F

The role of different manned and unmanned spacecraft in studying the earth's natural environment is discussed. Data from space technology in the areas of ecology, meteorology, and oceanography are summarized. The use of multispectral photography and atmospheric sounding from satellites is also discussed. K.M.M.

N74-19972# RAND Corp., Santa Monica, Calif.
A THREE-DIMENSIONAL MODEL FOR ESTUARIES AND COASTAL SEAS. VOLUME 1: PRINCIPLES OF COMPUTATION
Jan J. Leendertse, Richard C. Alexander, and S. -K. Liu Dec. 1973 66 p refs Sponsored by Office of Water Resources Res.
(R-1417-OWRR-Vol-1) Avail: NTIS HC $6.50

The principles of computation are presented for a three dimensional model of estuaries, bays, and coastal seas in which non-isotropic density conditions exist. Numerical integration of the finite difference equations for motion, transport, and continuity are used. In these equations the vertical momentum exchange is quadratically related to horizontal velocities, and the effects of vertical accelerations are neglected. The computational method was tested on a number of basins with boundaries of increasing complexity. A computation for a large lake with irregular boundaries and depth with a horizontal grid of 1000 points and 8 layers took 30 minutes on an IBM 360-91 for a real-time simulation of 67 hours in 4000 time steps. Results indicate that three-dimensional flows can be computed effectively according to this method. Author

N74-19973# Instituto Geografico y Catastral, Madrid (Spain).
ORIENTATION OF THE PARKINSON VECTOR IN THE EBRO AND LOERONO OBSERVATORIES [ORIENTACION DEL VECTOR DE PARKINSON EN LOS OBSERVATORIOS DEL EBRO Y LOGRONO]
Tomas Miguel Lafuente 1973 21 p refs In SPANISH; ENGLISH summary
Avail: NTIS HC $4.25

The results are presented which were obtained applying the Parkinson's method on simultaneous phenomena registered at the EBRO and LOGRONO observatories in Spain. Phenomena like bays were studied on which the amplitudes were measured to deduce the variations of H, D and Z for determinating the values of the angles alpha and omega, which were finally plotted. They show, that the Parkinson's vectors, are of opposite signs. Author

N74-19974# Ecosystems International, Inc., Millersville, Md.
THE PRACTICAL UTILIZATION OF REMOTE SENSING TECHNOLOGY FOR THE MANAGEMENT AND CONSERVATION OF NATURAL RESOURCES. PART 2: WATER RESOURCES MANAGEMENT
Peter A. Castruccio and Harry L. Loats, Jr. Mar. 1974 70 p refs
Avail: NTIS HC $6.50 CSCL 08H

Satellite remote sensing data and its use as a tool in water resource management are examined. A working methodology

for the utilization of remote sensing as well as illustrations of the technology are given. Other areas covered include flood plain identification, flood plain mapping, and construction of ungaged water shed models. E.H.W.

N74-19975# Interior Dept., Washington, D.C.
FINAL ENVIRONMENTAL STATEMENT FOR THE GEOTHERMAL LEASING PROGRAM. VOLUME 2: LEASING OF GEOTHERMAL RESOURCES IN THREE CALIFORNIA AREAS
1973 517 p refs 4 Vol.
Avail: SOD HC $5.85

Individual environmental statements are presented for the leasing of federally owned geothermal resources for development in three specific areas: (1) Clear Lake geysers; (2) Mono Lake-Long Valley; and (3) Imperial Valley. Also included is a summary of comments and responses relative to the draft environmental impact statement issued in 1971. Author

N74-19976# Interior Dept., Washington, D.C.
FINAL ENVIRONMENTAL STATEMENT FOR THE GEOTHERMAL LEASING PROGRAM. VOLUME 3: PROPOSED GEOTHERMAL LEASING AND OPERATING REGULATIONS
1973 697 p refs 4 Vol.
Avail: SOD HC $5.60

Proposed leasing and operating regulations to implement the Geothermal Steam Act are presented. Included are a study comparing vapor dominated hydrothermal systems with hot water systems, and a classification of public lands valuable for geothermal steam and associated geothermal resources. G.G.

N74-19977# Interior Dept., Washington, D.C.
FINAL ENVIRONMENTAL STATEMENT FOR THE GEOTHERMAL LEASING PROGRAM. VOLUME 4: COMMENTS ON DRAFT IMPACT STATEMENT AND PROPOSED REGULATIONS
1973 726 p refs 4 Vol.
Avail: SOD HC $5.65

Comments received from Federal, State, local, and individual interests on the leasing and operating regulations, the draft environmental impact statement for the Geothermal Leasing Program, and the supplement to the draft statement are presented. Author

N74-19978*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HYDROLOGIC APPLICATIONS OF NIMBUS 5 ESMR DATA
T. J. Schmugge, A. Rango, L. J. Allison, and T. T. Wilheit Feb. 1974 27 p refs
(NASA-TM-X-70614; X-910-74-51) Avail: NTIS HC $4.50 CSCL 08H

A region of low brightness temperature lying along the Mississippi River from Cairo, Illinois, to Morganza, Louisiana was observed in early Nimbus 5 Electrically Scanning Microwave Radiometer images. This region, which generally corresponds to an outwash aquifer in the Mississippi Valley, had brightness temperatures, at times as much as 40 K below the surrounding (drier) older uplands. Fluctuations of as much as 30 K were observed during the time interval 15 December 1972 to 28 February 1973. Comparison images taken from the Earth Resources Technology Satellite indicate that the study area is aligned with the Mississippi River floodplain, a region of potentially high soil moisture content. The brightness temperature fluctuations were compared with variations in precipitation and other hydrologic parameters in order to delineate the causative factors. Author

N74-19979*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
THE 1973 ETHIOPIAN-RIFT GEODIMETER SURVEY
P. A. Mohr 28 Jan. 1974 114 p refs Sponsored by NASA
(NASA-CR-137357; SAO-Special-Rept-358; SAO-310-047)
Avail: NTIS HC $8.75 CSCL 08E

Remeasurement of the Adama, Lake Langana, and Arba Minch (Lake Margherita) geodimeter networks in 1973 has enabled Mohr's interpretation concerning possible surface ground deformation in the Ethiopian rift to be considerably developed. Extension appears to have occurred across the Mojjo-Adama horst at a rate of about 1 cm yr/1. The opposing rims of the Adama graben have not moved significantly relative to one another (between 1969 and 1973), but stations on the sliced graben floor show possible movement with a large rift-trend component. In the Wolenchiti quadrilateral, significant movement of station RABBIT is confirmed, but the radical change of vector (that of 1970-1971 to that of 1971-1973) casts doubt on a tectonic cause and seems to indicate that stations on steep hillslopes are liable to be unstable. South of the quadrilateral and east of the Adama graben, alternating rift-trend zones of extension and shortening appear to coexist. In the Lake Langana network, significant movements of the order of 0.5 cm yr/1 are directed perpendicular to the rift floor faulting. Author

N74-19980*# Scientific Translation Service, Santa Barbara, Calif.
LIGHT REGIME OF A TWO-LAYER ATMOSPHERE-SEA MEDIUM
S. D. Gutshabash Washington NASA Sep. 1973 20 p refs Transl. into ENGLISH from the book "Optika Okean i Atmosfery" Leningrad, Nauka Press, 1972 p 44-56
(Contract NASw-2483)
(NASA-TT-F-14776) Avail: NTIS HC $4.00 CSCL 04A

The problem of radiation diffusion in a two-layer medium is studied. Intensities of radiation at the boundary of the layers and radiation fields in the atmosphere and ocean are found. The boundary is assumed to be isotropic. Author

N74-19981*# Scientific Translation Service, Santa Barbara, Calif.
DIVISION OF THE PACIFIC OCEAN BASED ON TRANSPARENCY
E. N. Khalemskiy and V. I. Voytov Washington NASA Sep. 1973 13 p refs Transl. into ENGLISH from the book "Optika Okeana i Atmosfery" Leningrad, Nauka Press, 1972 p 181-187
(Contract NASw-2483)
(NASA-TT-F-14784) Avail: NTIS HC $4.00 CSCL 08J

The Pacific waters are classified, based on transparency, and hydro-optical regions in the Pacific are located and tested by means of statistical methods. Author

N74-19982*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
USE OF VISIBLE, NEAR-INFRARED, AND THERMAL INFRARED REMOTE SENSING TO STUDY SOIL MOISTURE
Maxwell B. Blanchard, Ronald Greeley (Santa Clara Univ., Calif.), and Robert Goettelman (LFF Corp., Calif.) Apr. 1974 9 p refs
(NASA-TM-X-62343) Avail: NTIS HC $4.00 CSCL 08M

Two methods are described which are used to estimate soil moisture remotely using the 0.4- to 14.0 micron wavelength region: (1) measurement of spectral reflectance, and (2) measurement of soil temperature. The reflectance method is based on observations which show that directional reflectance decreases as soil moisture increases for a given material. The soil temperature method is based on observations which show that differences between daytime and nighttime soil temperatures decrease as moisture content increases for a given material. In some circumstances, separate reflectance or temperature measurements yield ambiguous data, in which case these two methods may be combined to obtain a valid soil moisture determination. In this combined approach, reflectance is used to estimate low moisture levels; and thermal inertia (or thermal diffusivity) is used to estimate higher levels. The reflectance method appears promising for surface estimates of soil moisture, whereas the temperature method appears promising for estimates of near-subsurface (0 to 10 cm). Author

N74-19983*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
MEASUREMENT OF ATMOSPHERIC PRECIPITABLE WATER USING A SOLAR RADIOMETER
David E. Pitts, Alyce E. Dillinger (Lockheed Electronics Co.), and William McAllum Feb. 1974 27 p refs

(NASA-TM-X-58129; JSC-08682) Avail: NTIS HC $4.50 CSCL 04A

A technique is described and tested that allows the determination of atmospheric precipitable water from two measurements of solar intensity: one in a water-vapor absorption band and another in a nearby spectral region unaffected by water vapor. Author

N74-19984*# Techtran Corp., Silver Spring, Md.
STATISTICAL CHARACTERISTICS OF THE LIGHT SCATTERING FUNCTION OF SEA WATER
O. V. Kopelevich and V. I. Burenkov Washington NASA Sep. 1973 12 p refs Transl. into ENGLISH from the book "Optika Okeana i Atmosfery" Nauka Press, Leningrad, 1972 p 126-136
(Contract NASw-2485)
(NASA-TT-F-14778) Avail: NTIS HC $4.00 CSCL 08J

A statistical analysis of the light scattering functions of sea water is carried out. Correlation and covariation matrices are calculated and empirically orthogonal vector functions are obtained. It is shown that the first three vectors provide a good approximation of scattering functions. Author

N74-19985*# Linguistic Systems, Inc., Cambridge, Mass.
TWO METHODS OF MEASURING THE SPECTRAL COEFFICIENTS OF LIGHT TRANSMISSION BY SUBSTANTIAL THICKNESSES OF SEA WATER
V. I. Eremin, G. G. Karlsen, and V. N. Pelevin Washington NASA Nov. 1973 9 p Transl. into ENGLISH from the book "Optika Okeana i Atmosfery" Nauka Press, Leningrad, 1972 p 120-125
(Contract NASw-2482)
(NASA-TT-F-14783) Avail: NTIS HC $4.00 CSCL 08J

Two different methods of measurements of the light tranmittance spectral coefficient T sub lambda for thick layers of the sea water by means of the meters with light spectral resolution are described. As an illustration some results of measurements of spectral distributions T sub lambda are given. Author

N74-19986*# Scripta Technica, Inc., Washington, D.C.
USING THE LIGHT SCATTERING FUNCTION FOR STUDYING SUSPENDED MATTER IN THE SEA
K. S. Shifrin, O. V. Kopelevich, V. I. Burenkov, and Yu. L. Mashtakov NASA Oct. 1973 21 p refs Transl. into ENGLISH from the book "Optika Okeana i Atmosfery" Nauka Press, 1972 p 25-43
(Contract NASw-2484)
(NASA-TT-F-14781) Avail: NTIS HC $4.25 CSCL 08J

The angular distribution of the light scattered by sea water and its intensity are determined by the quantity, the dimensions, and the shape of the particles suspended in the sea water. By measuring the light scattering functions (phase functions) the optical information can be used to calculate the size distribution of the particles suspended in the water. Two instruments are used for measuring the scattering envelopes of sea water; a visual spectro-hydronephelometer transmission meter and an objective measuring device for small-angle scattering. Data on the composition of suspended sea matter, obtained by the optical and geological methods, were compared and it was found that the optical data agree with the geological data in order of magnitude and likewise yield an overall identical size distribution behavior for suspended sea particles. The use of these methods for studying suspended sea matter is very promising; however, certain difficulties, associated with the specific suspended sea matter, arise in the conversion of the optical information. A.L.

N74-19987# National Oceanographic Data Center, Washington, D.C.
USER'S GUIDE TO NODC'S DATA SERVICES
Feb. 1974 76 p *Its* Key to Oceanographic Records Documentation no. 1
Avail: SOD HC $1.20

The User's Guide to NODC's Data Services, Revised February 1974, is a revision of the February 1973 edition, which superseded NODC Publication G-15, User's Guide for NODC's Data Processing Systems, 1969, of the former NODC General Series. The Guide is prepared to help users of NODC's services formulate requests for data and related information. It describes data bases and formats in which data can be obtained, contains examples of data listings, summaries, and displays, and explains entries and codes used in printout formats. New information and corrections to the February 1973 edition are included. Author

N74-19988# Joint Publications Research Service, Arlington, Va.
MINERAL RICHES OF THE PACIFIC OCEAN ORE ZONE
Ye. A. Radkevich 21 Mar. 1974 14 p Transl. into ENGLISH from Priroda (Moscow), no. 12, 1973 p 17-25
(JPRS-61544) Avail: NTIS HC $4.00

Data are presented on the origin of ore provinces and formulation of a theory of the origin of the Pacific Ocean zone. Author

N74-19989# Physical Research Lab., Ahmedabad (India).
GLOBAL EVOLUTION OF THE DS COMPONENT DURING GEOMAGNETIC STORMS
R. P. Kane 1973 16 p refs Submitted for publication
(AER-12) Avail: NTIS HC $4.00

Using the data of H values for several equatorial, low and middle latitude stations all round the globe, DS and electrojet strength changes during several geomagnetic storms are studied. Significant DS effects, viz. morning increase as well as dusk decreases, are noticed even during the main and recovery phase. Also, equatorial electrojet seems to weaken during the main phase and part of the recovery phase. Some relation with interplanetary plasma parameters is indicated for the IMP-1 period. Author

N74-19990# Battelle-Northwest, Richland, Wash.
STABLE AURORAL RED ARCS
R. J. Hoch [1973] 32 p refs
(Contract AT(45-1)-1830)
(BNWL-SA-4788; Conf-730962-1) Avail: NTIS HC $3.75

SAR-arcs are diffuse, persistent, practically monochromatic auroral forms peculiar to mid-latitude regions of earth. Measurements of such parameters as spectral composition, geomagnetic location, range of intensity, and frequency of occurrence lead to the conclusion that the phenomenon is due to the excitation of atomic oxygen by hot electrons in the plasmapause region. However, on the basis of the data available, it is not clear whether fresh electrons are precipitating into the region of the arc or whether ambient electrons are being heated in place. There is strong evidence that the source of energy in either case is the ring current. Suggested mechanisms by which energy is transferred from the ring current to the electrons in the SAR-arc region are: (1) heat flow, that is, transfer of kinetic energy to the SAR-arc region by Coulomb collisions, (2) transfer of ring current proton kinetic energy to hydromagnetic waves which are in turn damped by the electrons in the SAR-arc region, (3) direct influx of energetic electrons into the SAR-arc region. Which of these mechanisms predominates is still not resolved at this time. Author (NSA)

N74-19991# Battelle-Northwest, Richland, Wash.
SOME INFLUENCES OF REGIONAL BOUNDARY LAYER FLOW ON ATMOSPHERIC TRANSPORT AND DISPERSION
L. L. Wendell 1973 24 p refs Presented at the Am. Chem. Soc. 2d Joint Conf. on Sensing of Environ. Pollutants, Washington, D. C., 10 Dec 1973 Sponsored by AEC
(BNWL-SA-4819; Conf-731205-2) Avail: NTIS HC $3.25

The scales on which most atmospheric transport and diffusion work has been carried out have been either on the order of less than few kilometers or over a few hundred kilometers. Only recently has serious attention been turned to the intermediate scale on the order of a few tens of kilometers. It is on this regional scale in the boundary layer of the atmosphere that air pollution problems are becoming more critical. Recent investigations in several areas of the western United States have shown that the atmospheric transport of pollutants is strongly affected by intermediate scale variations in the topography. This spatial variation in the flow can cause short term emergency forecasts of plume transport or long term site evaluation studies based only on the source winds to be seriously in error. Instances

of several vertical shear in wind speed and direction may also be traced back to regional scale variation in terrain height.
Author (NSA)

N74-19992# Argonne National Lab., Ill.
THE WHAT SYSTEM: A NEW DIGITIZED RADIOSONDE AND DOUBLE THEODOLITE BALLOON TRACKING SYSTEM FOR ATMOSPHERIC BOUNDARY LAYER INVESTIGATIONS
Paul Frenzen and Lad L. Prucha 1973 9 p refs Presented at Am. Chem. Soc. 2nd Joint Conf. on Sensing of Environ. Pollutants, Washington, D. C., 10-12 Dec. 1973 Sponsored by AEC
(Conf-731205-1) Avail: NTIS HC $3.00

A semiautomatic system for obtaining measurements of wind and temperature through the lower several kilometers of the atmosphere with improved resolution and accuracy was developed. Two manually operated theodolites were equipped with high-resolution, pulse-type shaft encoders directly coupled to the elevation and azimuth axes of each instrument. Associated digital electronic and incremental tape equipment automatically records the four sighting angles in computer compatible form at preset intervals, as often as once each second. Balloons tracked for winds also carry transistorized radiosonde transmitters whose continuous temperature signals are recorded on the incremental tape along with the tracking data. A computer program subsequently averages several successive sets of sighting angles to smooth operator tracking errors, and calculates average winds, heights, and temperatures (hence the acronym), typically over periods of 10 to 20 seconds or through atmospheric layers 25 to 50 m thick. The system is fully portable and can be operated with storage batteries in the field. Author (NSA)

N74-19993# Denver Research Inst., Colo. Div. of Mathematical Sciences.
RAY METHOD FORMALISM FOR INTERNAL WAVES IN A DEEP OCEAN PROPAGATION, INITIATION, REFLECTION
Final Report
J. K. Cohen and Norman Bleistein 1 Nov. 1973 38 p refs
(Contract N00014-67-A-0394-0005; NR Proj. 041-434)
(AD-772095; MS-R-7405) Avail: NTIS CSCL 08/3

A ray method formalism is developed for the three dimensional propagation of small amplitude internal waves in an inviscid, incompressible fluid of arbitrary stable stratification in the presence of a transverse ambient flow. One of deduced results of the formalism is conservation of action density in the general context. Some of the unussual features of the propagation of these waves are discussed with special attention given to the reflection of internal waves. Author (GRA)

N74-19994# Defense Mapping Agency Aerospace Center, St. Louis, Mo. Technical Translation Branch.
THE GEOID OF AUSTRALIA (GEOID AVSTRALII)
N. P. Grushinskii and L. P. Pellinen Oct. 1973 38 p refs Transl. into ENGLISH from Soobshch. Gos. Astron. Inst. (Moscow), no. 174, 1972 p 3-28
(AD-772279; DMAAC-TC-1963) Avail: NTIS CSCL 08/5

The geoid for the territory of Australia was obtained according to the New Australian gravity survey. The influence of the remote areas was calculated by using satellite data. The anomalies in the areas without gravity measurements were obtained by successive interpolation with allowance for the relation of anomalies to heights. Comparison with Mather's and Fisher's derivations leads to errors on the order of plus or minus two m for the interior zones provided with surveys, and on the order of plus or minus four for the whole continent. A derivation of the orientation elements of the Australian ellipsoid was made. In conclusion, the primary necessity is pointed out for the gravimetric investigation of the South Sea. Author (GRA)

N74-19995# Defense Mapping Agency Aerospace Center, St. Louis, Mo. Technical Translation Branch.
THE MAIN GRAVITY REDUCTIONS AND SOME ERRORS OCCURRING FROM THEIR USE
N. P. Grushinskii and N. B. Sazhina Nov. 1973 19 p Transl. into ENGLISH from Soobshch. Gos. Astron. Inst. (Moscow), no. 174, 1972 p 42-53
(AD-772280; DMAAC-TC-1965) Avail: NTIS CSCL 08/5

The paper considers the problems of the free-air and Bouguer reductions and some errors connected with Bouguer anomalies, especially when used in the oceans. Author (GRA)

N74-19996# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
HEIGHT VARIATION ALONG SEA ICE PRESSURE RIDGES AND THE PROBABILITY OF FINDING HOLES FOR VEHICLE CROSSINGS
W. D. Hibler, III and S. F. Ackley Dec. 1973 14 p refs
(ARPA Order 1615)
(AD-772696; CRREL-SR-197) Avail: NTIS CSCL 08/10

Height variations along sea ice pressure ridges were studied to determine whether low spots in the ridges persisted over long enough distances for a wide vehicle such as the surface effect vehicle to pass through them. Heights along eight pressure ridges varying in length from 0.9 km to 2.2 km were measured at 5-m intervals using aerial photographic data obtained over the Beaufort Sea. The probabilities of finding holes at the mean heights of the ridges and 0.67 m above and below the mean heights were calculated as a function of the hole widths using an autocorrelation function obtained from the height data. The curves obtained were in good agreement with passage probabilities calculated directly from the data. (Modified author abstract)
GRA

N74-19997# Defense Mapping Agency Aerospace Center, St. Louis, Mo. Technical Translation Branch.
METHODS OF SOLUTION OF THE DIRECT PROBLEM OF GRAVIMETRIC SURVEYING
L. D. Nemtsov Nov. 1973 79 p refs Transl. into ENGLISH from the monograph "Vysokotochnaya Gravirazvedka" Moscow, 1967 p 5045
(AD-772272; DMAAC-TC-1962) Avail: NTIS CSCL 08/5

Three new methods are discussed for solving the direct problem of gravimetric surveying for three-dimensional geological masses of arbitrary form and dimensions. These methods provide a high accuracy and rate of computations and can be used by computers. Included are the following topics: Tables of direct gravity effects for computing gravity anomalies of three-dimensional bodies of arbitrary form and dimensions with the aid of a square graticule, nomograms for computing the gravitational effect of geological strate by a series of parallel cross sections, and procedure for computing the gravitational effect of gently sloping masses by the condensation method.
GRA

N74-19998# Naval Weapons Center, China Lake, Calif.
NUCLEATION ACTIVITY OF ORGANIC CLOUD-SEEDING AGENTS
Aaron N. Fletcher Dec. 1973 21 p refs
(AD-772528; NWC-TP-5592) Avail: NTIS CSCL 07/4

The report represents the third of a series of studies concerning the heterogeneous nucleation of supercooled water. The ultimate goal is to obtain fog and cloud seeding agents with a variety of operational characteristics. An equal effort is concerned with obtaining a better understanding of the principles of heterogeneous nucleation and the individual steps involved in freezing processes. The results of this study show that it is not possible to assign a meaningful threshold temperature to organic nucleants. This is particularly true for materials that are water soluble. For those compounds that are stable in the presence of water and are relatively insoluble, at least a two parameter exponential relationship is needed since different compounds show a different increase in the number of active nucleation sites as the temperature decreases. GRA

N74-19999# Aeronautical Research Associates of Princeton, Inc., N.J.
ATMOSPHERIC TURBULENCE AND THE DISPERSAL OF ATMOSPHERIC POLLUTANTS, VOLUME 1
Coleman duP. Donaldson Mar. 1973 211 p refs *Its* Environmental Monitoring Series
(Contract EPA-68-02-0014)
(PB-225524/8GA; ARAP-186-Vol-1; EPA-R4-73-016a) Avail: NTIS HC $5.50 CSCL 04A

A detailed derivation of the equations describing the generation of turbulence and the transport of pollutants in the

atmosphere is given. The equations are closed at the order of the second-order turbulent correlations through the use of models of the higher-order correlations. The resulting invariant second-order closure model is applied to three problems: (1) the generation of turbulence in the surface layer (computed results are compared with AFCRL experimental data); (2) the transport of passive pollutants in the atmosphere (computed results are compared with experimental data and suggestions for improving the model are made); (3) the complete planetary boundary layer for the case of neutral stability for both smooth and rough surfaces. The results of computations are compared with the results of previous investigations. GRA

N74-20000# Aeronautical Research Associates of Princeton, Inc., N.J.
DERIVATION OF A NON-BOUSSINESQ SET OF EQUATIONS FOR AN ATMOSPHERIC SHEAR LAYER, VOLUME 2
Coleman duP. Donaldson Mar. 1973 50 p refs 2 Vol.
(Contract EPA-68-02-0014)
(PB-225525/5GA; ARAP-186-Vol-2; EPA-R4-73-016b) Avail: NTIS HC $3.00 CSCL 04A

A detailed derivation of the equations which describe the generation of turbulence in the atmosphere and the equations which govern the transport of pollutants in the atmosphere is given. The equations are valid for motions which are small departures from an atmosphere at rest and in adiabatic equilibrium, but the usual assumption that the motion is restricted to thin layers, which leads to the Boussinesq approximation, is relaxed. GRA

N74-20001# Earth Satellite Corp., Washington, D.C.
EVALUATION OF ECONOMIC, ENVIRONMENTAL AND SOCIAL COSTS AND BENEFITS OF FUTURE EARTH RESOURCES SURVEY SATELLITE SYSTEMS Quarterly Progress Report, May - Jul. 1973
10 Aug. 1973 322 p refs
(Contract DI-14-08-0001-13519)
(PB-226036/2GA; USGS-DO-73-014; QPR-2) Avail: NTIS HC $18.25 CSCL 08F

A case study in agriculture crop acreage estimation was initiated and preliminary efforts were made to define resources, rangeland management, and land use planning. Progress to date leads to these observations: The ERTS-1 experimental results thus far represent relatively few data points. Applications of high potential benefits often depend on the redesign of a complex management information system to convert information extracted from ERS data into the form used in management decisions. Benefit measurement techniques appear to present fewer problems than experimental results or the management information models. The case studies defined to date vary substantially in their breadth of coverage. GRA

N74-20002# Army Electronics Command, Fort Monmouth, N.J.
AN ANALYSIS OF RANDOM FLUCTUATIONS OF ATMOSPHERIC DUST CONCENTRATIONS
David C. Henley Jan. 1974 20 p refs
(DA Proj. 1T0-61102-B-53A)
(AD-773824; ECOM-5530) Avail: NTIS CSCL 04/1

A modified structure function analysis is developed for and applied to time series data on the number concentration of atmospheric dust particles. Preliminary indications are that this application is a useful method of analysis. Systematic relationships of events manifested by the data are emphasized in a way which is potentially useful for the investigation of the causes of such relationships. Author (GRA)

N74-20003# Geological Survey, McLean, Va.
PRINCIPAL FACTS FOR GRAVITY STATIONS IN THE SAN LUIS OBISPO 1 DEGREE BY 2 DEGREE QUADRANGLE, CALIFORNIA Final Report
Stephen H. Burch, Roswitha B. Grannell (Calif. State Coll., Long Beach), William F. Hanna, and Robert F. Sikora 1973 53 p refs
(PB-226057/8GA; USGS-GD-73-035) Avail: NTIS HC $4.75 CSCL 08E

A total of 1589 gravity stations were obtained during the period 1965-1969 in the San Luis Obispo 1 degree by 2 degree quadrangle, California. This quadrangle extends from 35 to 36 degrees N lat. and from 120 to 122 degrees W long. A list of principal facts included in the report consists of station number, latitude, longitude, elevation, observed gravity, free-air anomaly, terrain correction, and Bouguer anomaly. Reduction to Bouguer anomalies was achieved using a density of 2.67 g/cc and terrain corrections to a distance of 166.7 km. Gravity data are companion to the reference: Burch, S. H., Grannell, R. B., and Hanna, W. F., 1971, Bouguer gravity map of California, San Luis Obispo Sheet: California Div. Mines and Geology, map, scale 1:250,000. (Modified author abstract) GRA

N74-20004# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PERIOD SPECTRAL SOLUTIONS OF A COMBINED SYSTEM OF EQUATIONS FOR THE PLANETARY DYNAMICS OF THE ATMOSPHERE AND THE HYDROSPHERE
V. A. Efimov 1 Jan. 1974 32 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 272, 1972 p 24-43
(AD-773509; FTD-HT-23-333-74) Avail: NTIS CSCL 04/2

The author describes the equations for the model of the combined dynamics of the atmosphere and ocean. GRA

N74-20005# Stanford Univ., Calif. Inst. for Plasma Research.
NUMERICAL SOLUTIONS FOR LONG UNMODULATED WHISTLER-MODE SIGNALS IN THE GEOMAGNETOSPHERE
C. E. Newman 20 Dec. 1973 21 p refs
(Contract N00014-67-A-0112-0062)
(AD-773650; SU-IPR-551) Avail: NTIS CSCL 04/1

The author gives a method for solving the integral equation derived in a previous report, governing the temperal evolution of the amplitude of a key-down whistler-mode signal which interacts with counter-streaming gyroresonant electrons in a limited region of the geomagnetosphere. Then, for a set of values of plasma and wave parameters typical for observations at $l = 3$, the author gives a family of solutions for a range of energetic electron densities. A certain critical density must be present in order for sustained quasi-periodic amplitude pulsations, similar to those reported in the literature, to occur. A second, and higher, critical density, above which the amplitude can actually undergo a change in sign is found; this corresponds to a 180 degree phase shift in the signal. The behavior of these solutions is then discussed from both a mathematical and a physical point of view. (Modified author abstract) GRA

N74-20006# Stanford Research Inst., Menlo Park, Calif.
UTAH STATE UNIVERSITY CIRCULAR VARIABLE FILTER SPECTROMETERS FOR AURORAL INFRARED MEASUREMENTS
C. K. Hinrichs Mar. 1973 29 p refs
(Contract DNA001-72-C-0143; DNA Proj. NWET-L25 AAXY)
(AD-773394; SRI-EGU-TN-1928-A6; DNA-3083T) Avail: NTIS CSCL 04/1

The technical note is one of a series that provides brief descriptions of scientific programs investigating the physics and chemistry of the upper atmosphere under normal and disturbed conditions in support of the High Altitude Effects Simulation (HAES) program of the Defense Nuclear Agency. In the absence of actual nuclear testing in the atmosphere a number of experiments are being carried out both in the laboratory and in the field to determine a sufficient number of parameters to characterize the environment and its reactions in a suitable model. This technical note describes one of these experiments. The circular variable filter (CVF) infrared spectrometer is one of the principal instruments used in rocket-borne experiments to measure auroral infrared emissions. The spectrometers described were developed by Utah State University and include both liquid nitrogen cooled short wavelength infrared and liquid helium cooled long wave infrared spectrometers. A brief description is also given of the CVF spectrometer experiments flown in the ICECAP 73 rocket series launched from Poker Flat, Alaska in March 1973. GRA

N74-20007# AeroChem Research Labs., Inc., Princeton, N.J.
UPPER ATMOSPHERIC CHEMICAL RELEASE TECHNIQUES

Final Technical Report, 1 Jan. - 30 Aug. 1973
W. Felder and Harold S. Pergament Oct. 1973 46 p refs
(Contract F30602-72-C-0420; ARPA Order 1469; AF Proj. 1649)
(AD-773337; AeroChem-TP-298; RADC-TR-73-375) Avail: NTIS CSCL 04/1

The goal of this work was to develop preliminary designs (in terms of composition, method of burning and size) of payload packages to release atomic Al and Fe vapors (emphasizing Al) in the upper atmosphere. The major effort was expended in demonstrating the feasibility of the Flashbulb technique for releasing significantly large amounts of atomic Al vapor. Feasibility has been demonstrated by showing experimentally that approximately 1% by weight of the Flashbulb composition (payload) is converted to Al vapor in small scale tests (i.e. a yield of 1%). Such a conversion efficiency is necessary to release a significantly large amount of Al vapor (approximately = 1 mole) from a full scale (approximately = 3 kg) payload. Specific amounts required for an actual release will, of course, be determined by the detection methods used and the purposes of the user. GRA

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N74-20008* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FORMATION OF STAR TRACKING RETICLES Patent
Wade O. Smith and Albert R. Toft, inventors (to NASA) Issued 26 Mar. 1974 6 p Filed 17 Apr. 1972 Supersedes N73-10460 (11 - 01, p 0056) Continuation-in-part of US Patent Appl. SN-80029, filed 12 Oct. 1970
(NASA-Case-GSC-11188-3; US-Patent-3,799,793; US-Patent-Appl-SN-244566; US-Patent-Class-117-45; US-Patent-Appl-SN-80029) Avail: US Patent Office CSCL 14B

The present application is directed towards a process for producing high resolution, substantially non-reflective reticles or choppers suitable for use for transmitting in both the visible and near ultra-violet regions, able to withstand reasonable handling and extreme environmental conditions, and capable of operating at speeds of from 2800 to about 9000 revolutions per minute without distortion. In particular, the present invention is directed towards the production or reticles having a quartz base vacuum coated with chromium, chromium-silver alloy, and silver with electrodeposited copper and black chromium thereon, respectively, in the form of a reticle pattern. The quartz permits the transmission of light while the pattern is opaque to light. The reticles of the present invention are intended for use in optical trackers, such as star trackers used in outer space.
Official Gazette of the U.S. Patent Office

N74-20009* National Aeronautics and Space Administration. Pasadena Office, Calif.
APPARATUS FOR SCANNING THE SURFACE OF A CYLINDRICAL BODY Patent
Robert B. Nakich (JPL) and Raymond C. Woodbury, inventors (to NASA) (JPL) Issued 26 Mar. 1974 7 p Filed 28 Jun. 1972 Supersedes N72-28461 (10 - 19, p 2564) Sponsored by NASA
(NASA-Case-NPO-11861-1; US-Patent-3,800,074; US-Patent-Appl-SN-266911; US-Patent-Class-178-6; US-Patent-Class-178-DIG.1; US-Patent-Class-178-7.6) Avail: US Patent Office CSCL 14B

A laser scanning system for providing a two-dimensional display of a cylindrical surface, such as to display striae of a fired bullet is described. The cylinder is scanned along its axis by vibrating one mirror in the laser beam path, and is scanned in a direction normal to its axis by vibrating a second mirror in a direction normal to the first or by rotating the bullet. Scan control signals are adjusted in phase to produce a synchronized display of a video signal obtained from detection of scattered light from the surface thus scanned by a laser beam.
Official Gazette of the U.S. Patent Office

N74-20010 Pennsylvania State Univ., University Park.
AN INVESTIGATION OF THE LASER SOURCE MASS SPECTROMETER Ph.D. Thesis
Edward Charles Beahm 1973 95 p
Avail: Univ. Microfilms Order No. 74-4215

Results obtained in laser mass spectrometric studies of inorganic solids were analyzed in terms of three processes: (1) vaporization, (2) ionization, and (3) vapor expansion-vapor reaction. In these studies a solid state (ruby or neodymium glass) laser operating in the normal mode with an output of one hundred thousand to one million watts per centimeter was coupled with a time of flight mass spectrometer. A simple steady state vaporization model was used. In this model the laser vaporizes the sample surface in a steady manner producing a crater. Ions for analysis in the mass spectrometer can be generated by the laser beam interacting with the sample and by mass spectrometer filament electrons of a specified energy. Experimental results and theoretical analysis show that thermal ionization can be assumed to be the major source of primary ions which result from laser photon absorption by the sample. Dissert. Abstr.

N74-20011 Oklahoma Univ., Norman.
EXPERIMENTAL ANALYSIS OF PROPELLER ANEMOMETER DYNAMIC PERFORMANCE Ph.D. Thesis
Fred Vincent Brock 1973 73 p
Avail: Univ. Microfilms Order No. 74-4000

A wind tunnel test for propeller anemometers has been devised. The tunnel speed is controlled to produce a large amplitude, low-frequency wind speed fluctuation which is periodic. The frequency can be adjusted, within limits to excite nonlinear response from a propeller anemometer. The tunnel speed was monitored with a hot-film anemometer. The data were recorded on an analog recorder, digitized and reduced to a compact form of averaged Fourier coefficients from which smoothed data could be reconstructed. The data analysis procedure comprised integration of the hot-film anemometer data stream according to a nonlinear ordinary differential equation with two parameters. A set of error data were formed by taking the difference between the model output and the observed anemometer output. An optimizing routine was used to adjust the two model parameters to minimize the error variance. Dissert. Abstr.

N74-20012*# Tyco Labs., Inc., Waltham, Mass. Technology Center.
CARBON MONOXIDE DETECTOR Final Report, 26 Jun. 1972 - 25 Jun. 1973
G. L. Holleck, J. L. Bradspies, S. B. Brummer, and L. L. Nelsen Dec. 1973 68 p refs
(Contract NAS8-29031)
(NASA-CR-120171) Avail: NTIS HC $6.50 CSCL 14B

A sensitive carbon monoxide detector, developed specifically for spacecraft use, is described. An instrument range of 0 to 60 ppm CO in air was devised. The fuel cell type detector is used as a highly sensitive electrolysis cell for electrochemically detecting gases. The concept of an electrochemical CO detector is discussed and the CO oxidation behavior in phosphoric and sulfuric acid electrolytes is reported. K.M.M.

N74-20013*# Kanner (Leo) Associates, Redwood City, Calif.
MIRROR OPTICS OF X-RAY TELESCOPES AND A DESCRIPTION OF A PROGRAM FOR DESIGN OF AN OBJECTIVE
I. L. Beygman, L. A. Vaynshteyn, Yu. P. Voynov, and V. P. Shevelko Washington NASA Oct. 1973 44 p refs Transl. into ENGLISH of Acad. of Sci. USSR, P. N. Lebedev Phys. Inst. preprint no. 112, 1973 61 p
(Contract NASw-2481)
(NASA-TT-F-14771; Preprint-112) Avail: NTIS HC $5.25 CSCL 20F

Mirror optics allowed a comparatively large collecting area to be used with small detector dimensions, while increasing the signal to noise ratios. Mirror objectives also made it possible to produce images similar to those yielded by telescopes in the ordinary visible range of the spectrum. Collecting systems, both cone and paraboloid, were studied for producing the greatest

effective area with fixed dimensions. The small diameter of the detector entry window used with mirror systems made it possible to use semiconductor detectors and channeltrons, as well as gas counters, to study soft X rays. J.A.M.

N74-20014*# Illinois Univ., Urbana.
THREED: A COMPUTER PROGRAM FOR THREE DIMENSIONAL TRANSFORMATION OF COORDINATES Photogrammetry Series No. 39
Kam W. Wong Jan. 1974 112 p refs
(Contract NAS9-12446)
(NASA-CR-134208; UILU-ENG-74-2004) Avail: NTIS HC $8.75 CSCL 08B

Program THREED was developed for the purpose of a research study on the treatment of control data in lunar phototriangulation. THREED is the code name of a computer program for performing absolute orientation by the method of three-dimensional projective transformation. It has the capability of performing complete error analysis on the computed transformation parameters as well as the transformed coordinates. Author

N74-20015*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN EXPERIMENT IN MANIPULATOR CONTROL WITH PROXIMITY SENSORS
Alan R. Johnston 1 Apr. 1974 12 p refs
(Contract NAS7-100)
(NASA-CR-137355; JPL-TM-33-678) Avail: NTIS HC $4.00 CSCL 14B

Optical proximity sensors were used in a feedback loop to automatically position a manipulator hand for grasping. The experiment was a simplified one, involving two dimensional motion only. Two proximity sensors were mounted on the hand, and control signals derived from their outputs were used to drive the hand vertically and horizontally. The sensors employ a pulsed gallium arsenide light-emitting diode together with a silicon detector. They indicate, without contact, the approximate distance between the manipulator hand and object in the range from 5 to 12 cm. Positioning within approximately + or - 5 mm was observed. Extension of the technique to general three-dimensional control is briefly discussed. Author

N74-20016*# Wisconsin Univ., Madison. Inst. for Environmental Studies.
PHOTOGRAPHIC QUANTIFICATION OF WATER QUALITY IN MIXING ZONES
Thomas M. Lillesand (State Univ. of New York), Frank L. Scarpace, and James L. Clapp [1973] 26 p refs Sponsored in part by Dept. of Natural Res., State of Wisconsin
(Grant NGL-50-002-127)
(NASA-CR-137268) Avail: NTIS HC $4.50 CSCL 14E

A method was developed to quantitatively delineate waste concentrations throughout waste effluent mixing zones on the basis of densitometric measurements extracted from aerial photography. A mixing zone is the extent of a receiving water body ultilized to dilute a waste discharge to a concentration characteristic of a totally mixed condition. Simultaneously-acquired color infrared photography and suspended solids water samples were used to quantitatively delineate the mixing zone resulting from the discharge of a paper mill effluent. Digital scanning microdensitometer data was used to estimate and delineate suspended solids concentrations on the basis of a semi-empirical model. Photographic photometry, when predicated on a limited amount of ground sampling, can measure and delineate mixing zone waste distributions in more detail then conventional surface measuring techniques. The method has direct application to: (1) the establishment of definite and rational water quality guidelines; (2) the development of sampling and surveillance programs for use by governmental and private agencies; and (3) the development of design and location criteria for industrial and municipal waste effluent outfalls. Author

N74-20017*# Wisconsin Univ., Madison. Inst. for Environmental Studies.
ANALYSIS OF MULTI-LAYERED FILMS
Frank L. Scarpace and Alan W. Voss [1973] 23 p refs
(Grant NGL-50-002-127)
(NASA-CR-137284) Avail: NTIS HC $4.25 CSCL 14E

Dye densities of multi-layered films are determined by applying a regression analysis to the spectral response of the composite transparency. The amount of dye in each layer is determined by fitting the sum of the individual dye layer densities to the measured dye densities. From this, dye content constants are calculated. Methods of calculating equivalent exposures are discussed. Equivalent exposures are a constant amount of energy over a limited band-width that will give the same dye content constants as the real incident energy. Methods of using these equivalent exposures for analysis of photographic data are presented. Author

N74-20018*# Techtran Corp., Glen Burnie, Md.
HIGH-SPEED LOGARITHMIC PHOTODETECTORS WITH WIDE INPUT SIGNAL RANGE
V. V. Bacherikov, V. E. Kagayn, Yu. A. Makarov, and B. M. Stepanov Washington NASA Oct. 1973 7 p refs Transl. into ENGLISH from Pribory i Tekh. Eksperim (Moscow), no. 3, 1972 p 193-195
(NASw-2485)
(NASA-TT-F-14769) Avail: NTIS HC $4.00 CSCL 20F

A description is given of high-speed (passband > 20 MHz) logarithmic photodetectors with a large input signal range (up to 100,000). The methods and facilities of obtaining nonlinear luminous characteristics over a wide amplitude and time range are discussed. The results are presented of a study of the amplitude and time characteristics of photodetectors based on certain photimultipliers. The mechanism of nonlinear conversion of electron fluxes (conversion regulated by a space charge) is discussed. Author

N74-20019*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MULTICHANNEL LOGARITHMIC RF LEVEL DETECTOR Patent Application
Chase P. Hearn and Curtis L. Shriver, inventors (to NASA) Filed 21 Mar. 1974 11 p
(NASA-Case-LAR-11021-1; US-Patent-Appl-SN-453115) Avail: NTIS HC $4.00 CSCL 14B

A logarithmic radio frequency level detector which can be used to derive gain-weighting signals in an n-channel angle modulation diversity receiving system is discussed. The intermediate frequency signals in the n-channel receiving system are sequentially gated into a single logarithmic intermediate frequency amplifier which compresses the input signal dynamic range by a factor on the order of one hundred to one. The invention is applicable to any situation in which it is desired to measure the amplitudes of a number of radio frequency signals with low differential error. NASA

N74-20020*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
RECORDING APPARATUS Patent Application
Sherman A. Clevenson, Andrew C. Dibble, Thomas K. Lusby, Jr., David G. Stephens, and Harland F. Scholl, inventors (to NASA) Filed 27 Feb. 1974 10 p
(NASA-Case-LAR-11353-1; US-Patent-Appl-SN-446561) Avail: NTIS HC $4.00 CSCL 14B

An apparatus for obtaining data to be used in evaluating the passenger comfort or ride quality of a surface vehicle is described. Both the random vibration produced by the vehicle and the spontaneous subjective responses of several passengers to the vibration are simultaneously measured and recorded. Adjacent channels of a tape recorder are used to record the data received from accelerometer mounted on the vehicle. NASA

N74-20021*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
GAS CHROMATOGRAPH INJECTION SYSTEM Patent Application
Glenn E. Pollock, Milton E. Henderson, and Ralph W. Donaldson, Jr., inventors (to NASA) Filed 27 Feb. 1974 12 p
(NASA-Case-ARC-10344-2; US-Patent-Appl-SN-446564) Avail: NTIS HC $4.00 CSCL 14B

An injection system is provided for a gas chromatograph. The crux of the invention is the employment of a chamber which is cool and not under pressure. The sample is placed in the

chamber and the solvent is removed by evaporation. The chamber is closed, then, by changing the position of the carrier gas control valve and heating the chamber, the sample is volatilized and swept by a carrier gas into the analysis apparatus. NASA

N74-20022*# National Aeronautics and Space Administration. Pasadena Office, Calif.

A DOPED JOSEPHSON TUNNELING JUNCTION FOR USE IN A SENSITIVE IR DETECTOR Patent Application

Melvin M. Saffren, inventor (to NASA) (JPL) Filed 19 Mar. 1974 26 p

(Contract NAS7-100)

(NASA-Case-NPO-13348-1; US-Patent-Appl-SN-452770) Avail: NTIS HC $4.50 CSCL 14B

A superconductive tunneling device with a modified tunnel barrier capable of supporting Josephson tunneling current is described. The device provides a particularly sensitive infrared detector of the Josephson junction type. The primary advantages of the invention are: (1) increased coupling of radiation to junctions, (2) making junctions more selective in their response to radiation, and (3) extending the response of the junctions to radiation of shorter wavelengths than can be found in a modified transfer Hamiltonian model. NASA

N74-20023*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

AUTONOMOUS MANIPULATION ON A ROBOT: SUMMARY OF MANIPULATOR SOFTWARE FUNCTIONS

R. A. Lewis 15 Mar. 1974 86 p refs

(Contract NAS7-100)

(NASA-CR-137354; JPL-TM-33-679) Avail: NTIS HC $7.50 CSCL 14B

A six degree-of-freedom computer-controlled manipulator is examined, and the relationships between the arm's joint variables and 3-space are derived. Arm trajectories using sequences of third-degree polynomials to describe the time history of each joint variable are presented and two approaches to the avoidance of obstacles are given. The equations of motion for the arm are derived and then decomposed into time-dependent factors and time-independent coefficients. Several new and simplifying relationships among the coefficients are proven. Two sample trajectories are analyzed in detail for purposes of determining the most important contributions to total force in order that relatively simple approximations to the equations of motion can be used. Author

N74-20024*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

LASER DOPPLER VELOCIMETER MEASUREMENTS IN A TURBINE STATOR CASCADE FACILITY

R. G. Seasholtz 1974 12 p refs Presented at the Laser Velocimetery Workshop, West Lafayette, Ind., 27-29 Mar. 1974

(NASA-TM-X-71524; E-7919) Avail: NTIS HC $4.00 CSCL 14B

A laser Doppler velocimeter (LDV) developed for mapping the flow velocity downstream from a 32-inch diameter annular cascade of turbine stator vanes is described. The LDV measurements were taken in a plane located approximately 0.5 inch downstream of the trailing edges of the vanes. Two components of the mean velocity (axial and circumferential) were measured. The flow velocities were in the high subsonic range. The LDV optics are of the dual scatter type with off-axis collection of the scattered light. The electronics system is based on the measurement of the time interval corresponding to eight periods of the Doppler signal and has a range of 10 to 80 MHz. The LDV measurements are compared with previous measurements made with a pressure probe. Author

N74-20025*# Linguistic Systems, Inc., Cambridge, Mass.

AN OBJECTIVE LENS HYDROSPECTRONEPHELOMETER FOR MEASURING, IN SITU, THE OPTICAL CHARACTERISTICS OF SEA WATER

B. F. Kelbalikhanov and E. I. Karsovskiy Washington NASA Nov. 1973 13 p refs Transl. into ENGLISH from the book "Optika Okeana i Atmosfery" Leningrad, Nauka Press, 1972 p 113-120

(Contract NASw-2482)

(NASA-TT-F-14786) Avail: NTIS HC $4.00 CSCL 14B

A description is given of a meter for measuring in situ the scattering light indicatrix at very small angles. The results of measurements in the Black Sea at angles below 1 degree are presented. Author

N74-20026# Nagoya Univ. (Japan). Inst. of Plasma Physics.

THE CALIBRATION OF THE ELECTROSTATIC ENERGY ANALYZER FOR QUANTITATIVE UTILIZATION

Hussein M. Saad Nov. 1973 23 p refs

(IPPJ-T-17) Avail: NTIS HC $4.25

The problems associated with the calibration process of electrostatic analyzers for quantitative utilization are, often, the ion source, the detector, and the measuring system. A simple ion source to fit such a process was selected and calibrated. It gave a linear relation between the electron emission current and the output ion current. The Daly-type detector was used and its characteristic curves are plotted. Absolute amplification factors for both the target and the scintillator are deduced at different target potentials. Finally, the counting method was applied. It showed linearity for comparatively small currents after which it was saturated due to the pile up problem. Author

N74-20027*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Opitcs Div.

MSDS SKY REFERENCE AND PREAMPLIFIER STUDY Final Report, 1 Nov. 1972 - 1 Sep. 1973

L. Larsen, S. Stewart, and P. Lambeck Mar. 1974 68 p refs

(Contract NAS9-9784)

(NASA-CR-134222; ERIM-190110-1-F) Avail: NTIS HC $6.50 CSCL 14B

The major goals in re-designing the Multispectral Scanner and Data System (MSDS) sky reference are: (1) to remove the sun-elevation angle and aircraft-attitude angle dependence from the solar-sky illumination measurement, and (2) to obtain data on the optical state of the atmosphere. The present sky reference is dependent on solar elevation and provides essentially no information on important atmospheric parameters. Two sky reference designs were tested. One system is built around a hyperbolic mirror and the reflection approach. A second approach to a sky reference utilizes a fish-eye lens to obtain a 180 deg field of view. A detailed re-design of the present sky reference around the fish-eye approach, even with its limitations, is recommended for the MSDS system. A preamplifier study was undertaken to find ways of improving the noise-equivalent reflectance by reducing the noise level for silicon detector channels on the MSDS. Author

N74-20028# Institut Franco-Allemand de Recherches, St. Louis (France).

MEASUREMENT METHODS IN BALLISTICS

1973 329 p refs Partly in GERMAN and partly in FRENCH Proc. of a Colloq. held at St. Louis, France, Jun. 1973

(ISL-14/73) Avail: NTIS HC $19.50

Developments in the field of ballistic measuring equipment and methods are presented. A calibration balance, capable of calibrating all pressure gages, is described. The accuracy of Doppler radar for projectile velocity measurement is discussed. Several systems for the remote measurement of projectile velocity are considered with regard to accuracy. The application of lasers in measurements such as those of gun tube vibration, projectile velocity and rotation, and angular displacements, is dealt with. For individual titles, see N74-20029 through N74-20047.

N74-20029 Bundesminister fuer Verteidigung, Bonn (West Germany). Erprobungsstelle 91.

THE CALIBRATION OF PRESSURE GAGES USING A PRESSURE CALIBRATION BALANCE [DIE KALIBRIERUNG VON DRUCKAUFNEHMERN MITTELS EINER DRUCKEICHWAAGE]

K. F. Leisinger *In* Inst. Franco-Allemand de Rech. Meas. Methods in Ballistics 1973 p 9-16 In GERMAN (For availability see N74-20028 11-14)

The measuring chain and accuracy are limited to piezoelectric pressure gages. The calibration of piezoelectric gages was carried out by comparing two voltages U sub a and U sub aE at the end of the measuring chain. U sub a is produced by a pressure p before the pressure gage, and U sub aE by a charge calibration signal at the site of the pressure gage. ESRO

N74-20030 Institut Franco-Allemand de Recherches, St. Louis (France).
GAS PRESSURE MEASUREMENT [GASDRUCKMESSUNG]
K. Zimmermann *In its* Meas. Methods in Ballistics 1973 p 17-31 In GERMAN (For availability see N74-20028 11-14)

The accuracy of piezoelectric gas pressure measurements is discussed in conjunction with the plastic deformation measurement of a copper cylinder in a pressure point. The bomb was connected to a Michelson interferometer with a He-Ne gas laser as radiation source, which serves to measure the deformation of the copper cylinder. The plastic deformation was verified by means of a micrometer. The results are compared with the interferometer data. ESRO

N74-20031 Bundesminister fuer Verteidigung, Bonn (West Germany). Erprobungsstelle 91.
MEASUREMENT OF PROJECTILE VELOCITY WITH HIGH ACCURACY [MESSUNG DER GESCHOSSGESCHWINDIGKEIT MIT HOHER GENAUIGKEIT]
Hans Twiling *In* Inst. Franco-Allemand de Rech. Meas. Methods in Ballistics 1973 p 33-45 In GERMAN (For availability see N74-20028 11-14)

The accuracy of measurement methods for projectile velocity in fixed and mobile weapon carriers is discussed. For fixed weapon carriers, projectile velocity was determined from a track length and time measurement. A projectile magnetized to saturation was shot through two single winding induction coils, which form the test range. For mobile weapon carriers, the projectile velocity was determined with Doppler radar. ESRO

N74-20032 Laboratoire Central de l'Armement, Arcueil (France). Dept. Electronique.
PERFORMANCE OF DOPPLER RADAR [PERFORMANCES DES RADARS DOPPLER] **c07**
M. Trognon *In* Inst. Franco-Allemand de Rech. Meas. Methods in Ballistics 1973 p 47-59 In FRENCH (For availability see N74-20028 11-14)

Doppler radar accuracy for the measurement of projectile velocity is discussed. A Doppler radar with traveling wave tubes and operating at 3 GHz was used. Velocity measurement accuracy depends principally on the Doppler frequency accuracy. This frequency can be measured either by counting periods during a predetermined time, or by counting clock signals during one or more periods. The two procedures are compared in theory, as well as in practice, with regard to accuracy and errors. ESRO

N74-20033 Institut Franco-Allemand de Recherches, St. Louis (France).
TELEMETRIC Vo MEASUREMENTS [TELEMETRISCHE Vo-MESSUNGEN] **c07**
G. Schultze *In its* Meas. Method in Ballistics 1973 p 61-69 In GERMAN (For availability see N74-20028 11-14)

A system for remote measurement of the initial velocity of projectiles is discussed. The projectile flies through an insulated ring attached to the muzzle. This ring was switched as an inductance in a MF oscillator; passage of the projectile increases the oscillator frequency. A ground receiver recorded the frequency pulses from which the projectile velocity can be derived. The system can also be applied to longer projectiles. ESRO

N74-20034 Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
MEASUREMENT ACCURACY REQUIREMENTS FOR THE DESIGN OF A BALLISTIC MISSILE SYSTEM [MESSGENAUIGKEITSFORDERUNGEN BEI DER AUSLEGUNG EINES FLUGKOERPERSYSTEMS] **c01**
E. Ahlborn *In* Inst. Franco-Allemand de Rech. Meas. Methods in Ballistics 1973 p 71-105 In GERMAN (For availability see N74-20028 11-14)

The attainable measurement accuracy with regard to determining the stability coefficients and the tangential force coefficient of a ballistic missile is treated numerically. The requirements of measurement accuracy were based on wind tunnel measurements. These can only partly apply to the stability coefficients, as their determination is necessary during the powered phase of the missile, which can hardly be simulated in a wind tunnel. A sufficiently exact determination of the tangential force coefficient in flight is possible providing the accuracy of altitude and velocity determination are taken into account. Proposals are made to obtain accuracy improvement of sensors to be used. ESRO

N74-20035 Rheinmetall G.m.b.H., Duesseldorf (West Germany).
DESCRIPTION OF AN ELECTRONIC LASER OPTICAL VIBRATION MEASUREMENT DEVICE [BESCHREIBUNG EINES ELEKTRONISCH-LASEROPTISCHEN SCHWINGUNGSMESSGERAETES] **c16**
Bornefeld *In* Inst. Franco-Allemand de Rech. Meas. Methods in Ballistics 1973 p 107-137 In GERMAN (For availability see N74-20028 11-14)

A laser optical measurement device was developed for determination of gun tube angle and path. This method allows the measurement of the vibration behavior of a gun tube during the passage of a projectile. The most important element of the device is a position sensitive photo diode which indicates and measures the position of a light point projected upon it in X and Y directions. ESRO

N74-20036 Etablissement d'Experiences Techniques, Bourges (France). Div. Mesures et Simulations.
THE UTILIZATION OF LASERS FOR THE MEASUREMENT OF SMALL ANGULAR DISPLACEMENTS [L'UTILISATION DES LASERS POUR LA MESURE DES PETITS ECARTS ANGULAIRES] **c16**
Delort *In* Inst. Franco-Allemand de Rech. Meas. Methods in Ballistics 1973 p 139-159 In FRENCH (For availability see N74-20028 11-14)

Two devices for the measurement of angular displacements, using lasers, are described. Both were developed for ballistic studies and weapon tests. One device permits measuring the aiming errors by measuring the angular displacement following one or two axes between the weapon's position at the moment of the shot and its original position corresponding to an ideal aim. Another device measures the attitude of projectiles. A nose mirror is attached to the projectile or missile. The projectile is then shot along laser-generated light beam, and its attitude can be measured from the reflected light. ESRO

N74-20037 Institut Franco-Allemand de Recherches, St. Louis (France).
TELEMETRIC LASER METHOD FOR MEASUREMENT OF SMALL ANGULAR ERRORS [TELEMETRISCHES LASERVERFAHREN ZUR MESSUNG KLEINER WINKELFEHLER] **c07**
B. Koch *In its* Meas. Methods in Ballistics 1973 p 161-173 In GERMAN (For availability see N74-20028 11-14)

A basic solution for measuring small angular errors of missiles launched from ramps at the start of their ballistic trajectory is discussed. The proposed method should make possible the measurement of the horizontal angular displacement by an optoelectronic method with telemetric data transmission in real time to a ground station. ESRO

N74-20038 Bundesminister fuer Verteidigung, Bonn (West Germany). Erprobungsstelle 91.
LEXANDER CAMERA [LEXANDER-KAMERA]
In Inst. Franco-Allemand de Rech. Meas. Methods in Ballistics 1973 p 175-197 In GERMAN (For availability see N74-20028 11-14)

The Lexander camera is a time stretcher camera with a rotating prism for optical image adjustment. The camera has a wide angle image field of 10 by 56 sq mm, and is therefore particularly suitable for recording phenomena along a straight line. An application of the camera to the investigation of missile motion during the first part of its trajectory is described. ESRO

N74-20039 Direction des Recherches et Moyens d'Essais, Paris (France). Section d'Etudes et Fabrication de Telecommunications.
MEASUREMENT OF METEOROLOGICAL DATA [MESURE DES DONNEES METEOROLOGIQUES] **c20**
I. A. Franc *In* Inst. Franco-Allemand de Rech. Meas. Methods in Ballistics 1973 p 199-207 In FRENCH (For availability see N74-20028 11-14)

The accurate measurement of certain meteorological parameters is discussed with a view to supplying these data to automated artillery units. The aerological parameters are pressure, temperature, temperature correction due to humidity, wind velocity, and wind direction. A network of mobile and autonomous stations provided with tracking radar for sounding balloons, telemetry receivers, etc., was set up in France. ESRO

N74-20040 Institut Franco-Allemand de Recherches, St. Louis (France).
ACCURACY OF THE GLOBAL DRAG COEFFICIENT OF A PROJECTILE IN FLIGHT DERIVED FROM DOPPLER-FIZEAU RADAR MEASUREMENTS [SUR LE COEFFICIENT DE TRAINEE GLOBALE D'UN PROJECTILE EN VOL, DEDUIT DE MESURES FAITES PAR RADAR DOPPLER-FIZEAU PRECISION] **c01**
M. Giraud and G. Simon *In its* Meas. Methods in Ballistics 1973 p 209-229 refs In FRENCH (For availability see N74-20028 11-14)

Drag coefficient measurement accuracy at zero incidence of a projectile was investigated for a ballistic tunnel. In an error analysis, the Doppler-Fizeau radar with a wavelength of 3.2 cm, which tracks the projectile on its trajectory, was taken into account. An evaluation of the accuracy produced 1% for a favorable case, and 10% for an unfavorable case. In order to increase accuracy, proposed improvements in the radar and photographic installations are supported. ESRO

N74-20041 Direction des Recherches et Moyens d'Essais, Paris (France). Service des Equipements de Champs de Tir.
NEW METHODS OF TRAJECTOGRAPHY [METHODES NOUVELLES DE TRAJECTOGRAPHIE]
Marvillet *In* Inst. Franco-Allemand de Rech. Meas. Methods in Ballistics 1973 p 231-241 In FRENCH (For availability see N74-20028 11-14)

Two methods for missile trajectory analysis are discussed. The SAFIR system is described. It is based on an infrared detector with Cassegrain optics. The associated electronics contain two types of cells for the spectral range 1.5 to 6 micron, a range adapted specifically to the IR emission of the missile propulsion system. A digital cinetheodolite accurately copies the SAFIR system position in order to record on film the missile trajectory. For real time trajectory analysis, a LIDAR system was proposed, and some relevant details are discussed. ESRO

N74-20042 Institut Franco-Allemand de Recherches, St. Louis (France).
TELEMETRIC MEASUREMENT OF IN-FLIGHT BALLISTIC DATA [TELEMETRISCHE MESSUNGEN BALLISTISCHER DATEN] **c07**
G. Schultze *In its* Meas. Methods in Ballistics 1973 p 243-257 In GERMAN (For availability see N74-20028 11-14)

The data transmission takes place using an acceleration-proof telemetry system realized in thick film technology. Types of measurement for 5-wide range weapon systems were surveyed. These include: time measurements, optoelectronic measurements of rotation, temperature measurement with thermoelements, and pressure measurements. Strain and vibration measurements are problematic, as the sensors have to be selected and calibrated. The accuracy and time resolution of the measurements are reviewed. ESRO

N74-20043 Bundesminister fuer Verteidigung, Bonn (West Germany). Erprobungsstelle 91.
PHYSICAL FUNDAMENTALS OF A MOBILE, IMMATERIAL TARGET PLATE [PHYSIKALISCHE GRUNDLAGEN EINER MOBILEN, IMMATERIELLEN TREFFBILDSCHEIBE] **c11**
Wolfgang Schumann *In* Inst. Franco-Allemand de Rech. Meas. Methods in Ballistics 1973 p 259-269 In GERMAN (For availability see N74-20028 11-14)

The objectives and realization of an optoelectronic target plate are discussed. The main objective is the automatic indication of the hit coordinates for single shots and series, especially for rapidly firing weapons. A special requirement is mobility. The advantages of this equipment are summed up, and the technical construction is detailed. ESRO

N74-20044 Laboratoire Central de l'Armement, Arcueil (France). Dept. Electronique.
AUTOMATIC TARGET [CIBLE AUTOMATIQUE] **c11**
Serge Perechodkin *In* Inst. Franco-Allemand De Rech. Meas. Methods in Ballistics 1973 p 271-289 In FRENCH (For availability see N74-20028 11-14)

An incorporal target consisting of laser beams and rotating mirrors is described. Two laser beams of different wavelength are reflected by two multiface mirrors rotating at high speed (200 rps), sweeping a plane, and reproducing an incorporal target of about 2 m in diameter. A projectile traveling through the plane will produce 2 echoes. By measuring the sweep time, the angles at the base of a triangle can be determined, of which the top is the projectile. The sensor information is fed into logic, and transmitted to a computer, from which the coordinates of the projectile may by calculated by trigonometry. ESRO

N74-20045 Etablissement d'Experiences Techniques, Bourges (France).
LOCALIZATION OF IMPACTS [REPERAGE DES IMPACTS] **c07**
Delagarde *In* Inst. Franco-Allemand de Rech. Meas. Methods in Ballistics 1973 p 291-301 In FRENCH (For availability see N74-20028 11-14)

The localization of grenade impacts on sea or land was studied. The Ratac system, based on Doppler radar, is proposed. The theoretical accuracy of the radar system is plus or minus 10 m in depth and plus or minus 2 m in direction. The useful field in practice is 500 m in depth and 100 m in direction. Several tests were carried out. ESRO

N74-20046 Institut Franco-Allemand de Recherches, St. Louis (France).
HOLOGRAPHIC MEASUREMENTS TO DETERMINE THE DISTRIBUTION AND THE SPEED OF PARTICLES OR CHIPS [MESURES HOLOGRAPHIQUE POUR DETERMINER LA REPARTITION ET LA VITESSE DE PARTICULES OU D'ECLATS] **c16**
H. Royer and F. Albe *In its* Meas. Methods in Ballistics 1973 p 303-313 refs In FRENCH (For availability see N74-20028 11-14)

Holographic interferometry was applied to analyze the results of projectile impact on ceramic material. Results obtained with a lead projectile of 9 mm caliber at a speed of 160 m/s are presented. The interferograms allow the calculation of deformation and speeds of deformation at each point on the sample surface. In addition, holography was applied to study a cloud of microparticles in motion. ESRO

N74-20047 Institut Franco-Allemand de Recherches, St. Louis (France).
SPECIAL DEVELOPMENTS AND APPLICATIONS OF BALLISTIC TELEMETRY FOR TESTS OF NEW AERODYNAMIC BODIES [SPEZIELLE ENTWICKLUNGEN UND EINSATZMOEGLICHKEITEN DER BALLISTISCHEN TELEMETRIE BEI DER ERPROBUNG NEUER FLUGKOERPER] **c07**
G. Schultze *In its* Meas. Methods in Ballistics 1973 p 315-319 In GERMAN (For availability see N74-20028 11-14)

Special miniature transmitters were developed for transmitting ballistic and other data from aerodynamic bodies, e.g. mines. An example is given for the localization of bodies dropped from a missile at an altitude of 1000 m. The state of this body and the function of the detonator after touchdown were investigated. These bodies were therefore equipped with simple and cheap telemetry devices. ESRO

N74-20048# Centre National de la Recherche Scientifique, Strasbourg (France). Lab. de Physique du Noyau et de Physique des Particules.
SCRO-BRANCH: READ-OUT SYSTEM FOR A MULTIWIRE PROPORTIONAL COUNTER (STANDARD PSEUDO-CAMAC)
J. D. Berst, Y. Chatelus, G. Metzger, G. Schaub, and G. Schultz Dec. 1972 20 p In FRENCH
(FRNC-R-26; CAMAC-16-00) Avail: AEC Depository Libraries HC $3.00

The multiwire proportional chamber read out system described is intended for a Xi hyperons yields neutron + pion

experiment. The general principle adopted is presented. A hybrid delay receiver amplifier unit of the line memory is associated with each wire. The touched wire thus produced a memorized logic signal if coincidence occurs with a gast strobe pulse from DISC. The system which is intended for the extraction of information from (SCRO-BRANCH) memories is described. NSA

N74-20049# Defense Documentation Center, Alexandria, Va.
PHOTOMICROGRAPHY Report Bibliography, Feb. 1961 - Jul. 1973
Jan. 1974 463 p refs
(AD-772800; DDC-TAS-73-78) Avail: NTIS

This bibliography contains unclassified and unlimited citations on photomicrography. These citations are studies and analysis relating to microscopy techniques and equipment in alloys, metals, compounds, films, plastics, coatings, fibers, biology, images, lasers, fractography and design requirements. This bibliography is topically arranged in the following alphabetical order: Section (1) Biological, Botany and Medical; (2) Coatings, Fibers, Graphite and Plastics; (3) Equipment and Techniques; (4) Films, Graphs, Images, and Lasers; (5) Inorganic Chemistry; (6) Metallurgy and Metallography, and (7) Miscellaneous. Corporate Author-Monitoring Agency, Subject, Title, and Personal Author Indexes are included. Author (GRA)

N74-20050# Rocket Propulsion Establishment, Westcott (England).
A QUADRUPOLE MASS FILTER FOR MOLECULAR BEAM DETECTION
R. G. Wilkins Jul. 1972 46 p refs
(AD-772473; RPE-TR-72/5; BR36358) Avail: NTIS CSCL 07/4

This report outlines the theory of the quadrupole mass filter and describes the design and construction of an instrument to analyze, in conjunction with a molecular beam sampling system, the composition of low pressure flames. The ancillary electronic equipment is also described. Some results are presented to show the resolution, sensitivity and stability of the instrument. (Modified author abstract) GRA

N74-20051# Army Electronics Command, Fort Monmouth, N.J.
FABRICATION AND ELECTRO-OPTICAL PROPERTIES OF LARGE AREA SINTERED PHOTOCONDUCTORS
Harvey A. Hodes Dec. 1973 20 p refs
(DA Proj. 1S6-62703-A-176)
(AD-772898; ECOM-4169) Avail: NTIS CSCL 14/5

The most sensitive photoconductor performance obtained thus far in photo-electrolytic imaging systems has employed sintered layers of cadmium sulfide or sulfo-selenide. The fabrication and electro-optical properties of large area sintered photoconductors particularly suited to electrolytic photography are described in detail. The electro-optical properties of sintered photoconductors and conventional resin embedded types are compared. Possible applications of this sintered layer to low light level photography, and to sandwich type image intensifier panels are briefly mentioned. (Modified author abstract) GRA

N74-20052# Franklin Inst. Research Labs., Philadelphia, Pa.
ADVANCED CAPACITATIVE OIL DEBRIS MONITOR Final Report
Richard H. Hollinger Aug. 1973 38 p refs
(Contract DAAJ02-72-C-0078; DA Proj. 1F1-62205-A-119)
(AD-772948; USAAMRDL-TR-73-53) Avail: NTIS CSCL 14/2

The object of this program was to design, build, and calibrate two models of an advanced capacitative oil debris monitor based on the principle and design of a prototype monitor. Two models were provided: one to cover an oil flow range up to 3 gallons per minute, and a second to cover the oil flow range of 3 gallons per minute to 12 gallons per minute. The report includes installation and operation instructions. (Modified author abstract) GRA

N74-20053# Naval Postgraduate School, Monterey, Calif.
A/D CONVERSION: A DIGITAL VOLTMETER M.S. Thesis
Mehmet Deniz Celbis Dec. 1973 42 p refs
(AD-772788) Avail: NTIS CSCL 14/2

During the past few years, advancement of the integrated circuit technology yielded medium and large scale integration of commonly used electronic circuitry. One of the special MSI devices commercially available today is the Fairchild 3814 Digital Voltmeter Logic Array which contains most of the logic required for a 4 1/2 decade digital Voltmeter. In this report the design of an inexpensive four digit, auto-scaling digital voltmeter is presented with results of tests performed on this meter. Author (GRA)

N74-20054# Civil Aeromedical Inst., Oklahoma City, Okla.
IN-FLIGHT PERFORMANCE OF CIVILIAN PILOTS USING MOVING-AIRCRAFT AND MOVING-HORIZON ATTITUDE INDICATORS
A. Howard Hasbrook Jun. 1973 21 p refs
(AD-773450; FAA-AM-73-9) Avail: NTIS CSCL 01/4

The in-flight performance of civilian instrument-rated pilots using two different types of attitude indicators in a general aviation aircraft was measured during typical instrument flying maneuvers. The instruments were an inside-out (moving-horizon) indicator and an outside-in (moving aircraft) indicator. The subjects were divided into low and high experience groups. The results of the study differ in some degree with those of some recent ground-based studies which used the same two concepts of attitude presentation. However, one result of the in-flight study agreed with many of the previous studies; low time pilots exhibited a narrower range of pitch excursions with the outside-in (moving aircraft) attitude indicator than they did with the inside-out (moving horizon) indicator. When combined with the authors' observations of a head-horizon tilt phenomenon relating to both humans and animals, the results of this study suggest the usefulness of a new concept for the design of the attitude indicator display. A new concept is described in the report. Author (GRA)

N74-20055# Ohio State Univ., Columbus.
OSU RADIO TELESCOPE
1974 17 p
Avail: NTIS HC $4.00

The characteristics of a radio astronomy telescope constructed at Ohio State University are described. Photographs and diagrams of the installation are provided. The surveys conducted with the telescope are discussed. It is stated that approximately 20,000 radio sources have been identified. Radio contour maps of the Andromeda galaxy and quasars with red shift are developed. A chronology of the events conducted during the radio astronomy program from 1950 to the present is included. Author

N74-20056# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COMBINED LIGHT SOURCE WITH COLD AND HOT HOLLOW CATHODES
Yu. B. Atnashev, V. N. Muzgin, and F. F. Gavrilov 30 Nov. 1973 10 p refs Transl. into ENGLISH from Zh. Prikl. Spektroskopii, Akad. Nauk Belorussk. SSR (Minsk), v. 18, no. 2, Feb. 1973 p 183-186
(AD-772649; FTD-HT-23-483-74) Avail: NTIS CSCL 14/2

The spectroanalytic characteristics of a double hollow cathode with separated vaporization and excitation zones are given, when employing a cooled hollow cathode as a cathode-exciter. The design of the discharge tube is shown. GRA

N74-20057# Burroughs Corp., Paoli, Pa. Defense, Space and Special Systems Group.
AUTOMOBILE CRASH SENSOR SIGNAL PROCESSOR Final Report, Apr. 1972 - Mar. 1973
C. J. Bader Nov. 1973 103 p refs
(Contract DOT-TSC-409-1)
(PB-225868/9GA; DOT-TSC-NHTSA-73-2; DOT-HS-800970)
Avail: NTIS HC $4.25 CSCL 13L

The crash sensor signal processor described interfaces between an automobile-installed Doppler radar and an air bag activating solenoid or equivalent electromechanical device. The processor utilizes both digital and analog techniques to produce an output pulse when specified input signal amplitude and frequency conditions are met. The device is intended to be implemented with monolithic MOS large scale integrated circuitry and bipolar driver. The design and reliability studies indicate

that very low cost and very high monolithic techniques without compromising processor performance. GRA

N74-20058# Naval Postgraduate School, Monterey, Calif.
REDESIGN OF THE LOW SPEED THREE STAGE AXIAL FLOW COMPRESSOR TEST FACILITY Progress Report
M. H. Vavre, P. F. Pucci, and W. Schlachter Dec. 1973 52 p refs
(AD-773748; NPS-57VA73121A) Avail: NTIS CSCL 14/2

A flow configuration of an existing low-speed, axial flow compressor test facility at the Turbopropulsion Laboratory, Naval Postgraduate School, Monterey, California, was redesigned in order to improve compressor inlet velocity distribution, improve mass flow measurement, and increase the power input. The design of the new configuration, consisting of an inlet nozzle, ducting, throttling device upstream of the compressor, and a diffusor downstream of it, is reported. The redesign is based on using the existing free-vortex type and solid-body type bladings, and the newly designed symmetrical blading. Author (GRA)

N74-20059# Honeywell, Inc., Minneapolis, Minn. Systems and Research Div.
AN INVESTIGATION OF AIRBORNE DISPLAYS AND CONTROLS FOR SEARCH AND RESCUE (SAR). VOLUME 8: ARMY MEDEVAC AVIONICS CAPABILITY STUDY Final Report, Nov. 1972 - Aug. 1973
A. L. Jones, W. A. Dalhamer, and R. J. Kirk Sep. 1973 42 p refs
(Contract N00014-69-C-0460; NR Proj. 213-072)
(AD-773611; Rept-12609-FRI-Vol-8; JANAIR-731001-Vol-8) Avail: NTIS CSCL 06/7

The report presents results of a study to assess the avionics capability of the present generation ARMY MEDEVAC helicopters (UH-1H). The study was based on interviews with experienced MEDEVAC pilots. Analyses were performed to evaluate the baseline avionics and potential improvements against various mission requirements and environmental conditions. The most critical needs identified in the study were night-vision aids and improved navigation capability. Author (GRA)

N74-20060# Naval Air Propulsion Test Center, Trenton, N.J.
DEVELOPMENT OF NDT/I FOR INTEGRAL WING FUEL TANK STRUCTURES USING INFRARED THERMOGRAPHY Final Report
Anthony P. Pontello Jan. 1974 18 p refs
(AD-773466; NAPTC-PE-32) Avail: NTIS CSCL 14/2

Infrared thermography was successful in detecting flaws in wing tank structures through changes in temperature pattern under controlled conditions. The flaws detected by Thermovision included voids, cracks, indentations, a loose fuel inspection plate, defective counter sunk screws, material imperfections and damaged honeycomb sections. Laser beams used as a heat source have a limited capability in providing heat patterns of defective materials scanned by Thermovision, but are worthy of further investigation with some modifications. Author (GRA)

N74-20061# ARO, Inc., Arnold Air Force Station, Tenn.
RADIOMETRIC COMPARISON OF A CAVITY INFRARED RADIATION SOURCE WITH A SELF-CALIBRATED CRYOGENIC BOLOMETER Final Report, 1 Jan. - 30 Apr. 1973
D. F. Frazine AEDC Jan. 1974 24 p refs
(AD-773943; ARO-VKF-TR-73-105; AEDC-TR-73-167) Avail: NTIS CSCL 14/2

An attempt was made to confirm the calculated value of emitted radiant power from a cavity radiation source by measuring it with a self-calibrated cryogenic bolometer. The measurement was done in high vacuum with 40K surroundings and a nominal radiant power of five nonowatts. Confirmation was not obtained because the self-calibrated bolometer could not be used as an absolute radiometer. However, the comparison effort led to improvements in the source of the radiation and to a better understanding of the bolometer. Author (GRA)

N74-20108 Perkin-Elmer Corp., Wilton, Conn.
SURFACE AND COATING ABSORPTION MEASUREMENT WITH AN ALPHAPHONE
E. L. Kerr *In* NBS Laser Induced Damage in Opt. Mater., 1973 Dec. 1973 p 189-193 refs (For availability see N74-20083 11-16)

N74-20116 Rockwell International Corp., Thousand Oaks, Calif. Science Center.
A SENSITIVE INTERFEROMETRIC NULL METHOD FOR MEASURING STRESS-INDUCED BIREFRINGENCE
George Birnbaum and Earl Cory *In* NBS Laser Induced Damage in Opt. Mater., 1973 Dec. 1973 p 254-258 refs (For availability see N74-20083 11-16)

N74-20262 National Bureau of Standards, Washington, D.C.
AN APPARATUS FOR PHOTOGRAPHING INTERFERENCE PHENOMENA
James B. Saunders *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 85-118 refs Repr. from J. Res. Natl. Bur. Stand., v. 35, Sep. 1945 p 157-186 (For availability see N74-20250 11-23)
(NBS-RP-1668)

N74-20264 National Bureau of Standards, Washington, D.C.
IN-LINE INTERFEROMETER
James B. Saunders *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 127-128 ref Repr. from J. Opt. Soc. Am., v. 44, no. 3, Mar. 1954 p 241-242 (For availability see N74-20250 11-23)

N74-20266 National Bureau of Standards, Washington, D.C.
PARALLEL TESTING INTERFEROMETER
James B. Saunders *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 135-142 refs Repr. from J. Res. Natl. Bur. Stand., v. 61, no. 6, Dec. 1958 p 491-498 (For availability see N74-20250 11-23)
(NBS-RP-2917)

N74-20267 National Bureau of Standards, Washington, D.C.
INTERFEROMETER FOR LARGE SURFACES
James B. Saunders and Franz L. Gross *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 143-145 refs Repr. from J. Res. Natl. Bur. Stand., v. 62, no. 4, Apr. 1959 p 137-139 (For availability see N74-20250 11-23)
(NBS-RP-2943)

N74-20268 National Bureau of Standards, Washington, D.C.
MEASUREMENT OF WAVE FRONTS WITHOUT A REFERENCE STANDARD: PART 1. THE WAVE-FRONT-SHEARING INTERFEROMETER
James B. Saunders *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 146-152 refs Repr. from J. Res. Natl. Bur. Stand., B. Math. Math. Phys., v. 65B, no. 4, Oct.-Dec. 1961 p 239-244 (For availability see N74-20250 11-23)

N74-20269 National Bureau of Standards, Washington, D.C.
MEASUREMENT OF WAVE FRONTS WITHOUT A REFERENCE STANDARD: PART 2. THE WAVE FRONT-REVERSING INTERFEROMETER
James B. Saunders *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 153-164 refs Repr. from J. Res. Natl. Bur. Stand., B. Math. Math. Phys., v. 66B, no. 1, Jan.-Mar. 1962 p 29-40 (For availability see N74-20250 11-23)
(Paper-66B1-70)

N74-20270 National Bureau of Standards, Washington, D.C.
WAVE FRONT SHEARING PRISM INTERFEROMETER
James B. Saunders *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 165-181 refs Repr. from J. Res. Natl. Bur. Stand., C. Eng. and Instr., v. 68C, no. 3, Jul.-Sep. 1964 p 155-171 (For availability see N74-20250 11-23)
(Paper-68C3-160)

N74-20271 National Bureau of Standards, Washington, D.C.
A SIMPLE, INEXPENSIVE WAVEFRONT SHEARING INTERFEROMETER
J. B. Saunders *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 182-184 refs Repr. from Appl. Opt., v. 6, Sep. 1967 p 1581-1583 (For availability see N74-20250 11-23)

N74-20272 National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
AN INTERFEROMETER FOR MEASURING GRADIENTS IN BOTH REFRACTIVE INDEX AND THICKNESS OF LARGE OR SMALL OPTICS
J. B. Saunders *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 185-188 refs Repr. from J. Res Natl. Bur. Stand., C, v. 73C, no. 1 and 2, Jan.-Jun. 1969 p 1-4 (For availability see N74-20250 11-23)
(Paper-73C-1/2-283)

N74-20282 National Bureau of Standards, Washington, D.C.
EQUIPMENT AND METHOD FOR PHOTOELECTRIC DETERMINATION OF IMAGE CONTRAST SUITABLE FOR USING SQUARE WAVE TARGETS
Fred W. Rosberry *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 534-541 refs Repr. from J. Res. Natl. Bur. Stand., C, v. 64C, no. 1, Jan.-Mar. 1960 p 57-64 (For availability see N74-20250 11-23)
(Paper-64C1-25)

N74-20283 National Bureau of Standards, Washington, D.C.
VARIATION OF RESOLVING POWER AND TYPE OF TEST PATTERN
Francis E. Washer and William P. Tayman *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 542-556 refs Repr. from J. Res. Natl. Bur. Stand., v. 64C, no. 3, Jul.-Sep. 1960 p 209-223 (For availability see N74-20250 11-23)
(Paper-64C3-39)

N74-20285 National Bureau of Standards, Washington, D.C.
MAGNIFICATION OF A TELESCOPE
Robert E. Stephens *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 561-562 refs (For availability see N74-20250 11-23)

N74-20297 National Bureau of Standards, Washington, D.C.
OPTICAL AUTOCORRELATOR WITH SPECIAL APPLICATION TO MTF MEASUREMENT
D. N. Grimes *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 633-637 refs Repr. from Appl. Opt., v. 11, Apr. 1972 p 914-918 (For availability see N74-20250 11-23)

N74-20299 National Bureau of Standards, Washington, D.C.
A NOMOGRAPH FOR SELECTING LIGHT BALANCING FILTERS FOR CAMERA EXPOSURE OF COLOR FILMS
C. S. McCamy *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 806-808 refs Repr. from Photogr. Sci. Eng., v. 3, no. 6, Nov.-Dec. 1959 p 302-304 Presented at Natl. Conf., Chicago, Oct. 1959 (For availability see N74-20250 11-23)

N74-20302 National Bureau of Standards, Washington, D.C.
PHOTOGRAPHIC IMAGE STRUCTURE EVALUATION
C. S. McCamy *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 851-859 refs (For availability see N74-20250 11-23)

N74-20304 National Bureau of Standards, Washington, D.C.
THE PRODUCTION OF PHOTOGRAPHIC EDGES OF EXTREME SHARPNESS
Calvin S. McCamy and Myron A. Berkovitz *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 35-36 Repr. from SPSE Conf.: Frontiers of Photo., May 1965 p 35-36 (For availability see N74-20250 11-23)
(Paper-21)

N74-20305 National Bureau of Standards, Washington, D.C.
ON THE INFORMATION IN A MICROPHOTOGRAPH
C. S. McCamy *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 470-476 refs Repr. from Appl. Opt., v. 4, Apr. 1965 p 405-411 (For availability see N74-20250 11-23)

N74-20306 National Bureau of Standards, Washington, D.C.
NEW PRINCIPLE OF ABSOLUTE PHOTOMETRY
Calvin S. McCamy *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 877 Repr. from JOSA, v. 53, no. 4, Apr. 1963 p 511 (For availability see N74-20250 11-23)

N74-20308 National Bureau of Standards, Washington, D.C.
DETERMINATION OF RESIDUAL THIOSULFATE IN PROCESSED FILM
Chester I. Pope *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 890-898 refs Repr. from J. Res. Natl. Bur. Stand., C, v. 67C, no. 3, Jul.-Sep. 1963 (For availability see N74-20250 11-23)
(Paper-67C3-134)

N74-20309 National Bureau of Standards, Washington, D.C.
INSPECTION OF PROCESSED PHOTOGRAPHIC RECORD FILMS FOR AGING BLEMISHES
C. S. McCamy *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 899-912 refs Repr. from NBS Handbook 96, 24 Jan. 1964 p 1-11 (For availability see N74-20250 11-23)
(NBS-Handbook-96)

N74-20310 National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
BLEMISH FORMATION IN PROCESSED MICROFILM
C. I. Pope *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 913-321 refs Repr. from J. Res. Natl. Bur. Stand., A, v. 72A, no. 3, May-Jun. 1968 p 251-259 (For availability see N74-20250 11-23)
(Paper-72A3-499)

N74-20311 National Bureau of Standards, Washington, D.C. Image Optics and Photography Section.
A SIMPLIFIED METHOD FOR DETERMINING RESIDUAL THIOSULFATE IN PROCESSED MICROFILM
C. I. Pope *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 922-923 refs Repr. from Photogr. Sci. Eng., v. 13 no. 5, Sep.-Oct. 1969 p 278-279 (For availability see N74-20250 11-23)

N74-20312 National Bureau of Standards, Washington, D.C.
REDOX BLEMISHES: THEIR CAUSE AND PREVENTION
C. S. McCamy and Chester I. Pope *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 924-929 refs Presented at Natl. Microfilm Assoc., Boston, 7 May 1969 (For availability see N74-20250 11-23)

N74-20351 Nagoya Univ. (Japan). Electrotechnical Lab.
DESIGN OF SIN-COS-PROBE FOR ETL-TPE-1
Eiichi Yahagi *In its* The Record of Symp. on Plasma Diagnostics Dec. 1973 p 1-8 (For availability see N74-20350 11-23)

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection.

N74-20062 Central Electricity Generating Board, London (England).
SHAFT VOLTAGES AND BEARING CURRENTS IN ELECTRIC MACHINES: A SELECTED BIBLIOGRAPHY, 1950-NOVEMBER 1970
B. H. Jones, comp. Jan. 1974 8 p refs
(CE-Bib-20D) Avail: Issuing Activity
A bibliography of 35 abstracts concerning voltages in electrical machinery is presented. S.K.W.

N74-20063* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
REEFING SYSTEM Patent
Harry V. Fuller, inventor (to NASA) Issued 12 Mar. 1974 6 p Filed 29 Dec. 1972 Continuation-in-part of US Patent Appl. SN-99201, filed 17 Dec. 1970
(NASA-Case-LAR-10129-2; US-Patent-3,796,473; US-Patent-Appl-SN-319410; US-Patent-Class-312-1; US-Patent-Appl-SN-99201) Avail: US Patent Office CSCL 13E
A mechanical device for receiving a cable and controlling

the motion of the cable is described. The cable moves freely in one direction and movement is resisted in the opposite direction until the forces exerted on the cable exceed a predetermined amount. Exceeding the minimum amount of force permits the cable to move in the opposite direction. Diagrams of the device are included. Official Gazette of the U.S. Patent Office

N74-20064 Engineering Sciences Data Unit, London (England).
CALCULATION METHODS FOR STEADILY LOADED FIXED-INCLINED-PAD THRUST BEARINGS
Nov. 1973 30 p refs Sponsored by Inst. of Mech. Engr.
(ESDU-73030) Avail: Issuing Activity

Calculation methods and charts are given to aid in the design of fixed-inclined-pad thrust bearings. The bearings are considered to be steadily loaded, but may also be applied to bearings with loads varying slowly. In order that some thrust load can be carried from standstill, a portion of each thrust pad is made parallel to the runner. Author

N74-20065 Engineering Sciences Data Unit, London (England).
DESIGN OF PARALLEL AXIS STRAIGHT SPUR AND HELICAL GEARS: BACKLASH AND INSPECTION DIMENSIONS
Jun. 1973 4 p Sponsored by Inst. of Mech. Engr.
(ESDU-68028-Amend-A) Copyright. Avail: Issuing Activity

Notations and units for backlash and inspection dimensions are conjugated to a British standard rack of specified normal pitch. Other dimensions required to check tooth thickness by various methods of measurement are also given. Author

N74-20066 Rensselaer Polytechnic Inst., Troy, N.Y.
THE CORROSION AND STRESS CORROSION CRACKING BEHAVIOR OF STAINLESS STEEL WELDMENTS CONTAINING FERRITE Ph.D. Thesis
Ronald Harold Sherman 1973 161 p
Avail: Univ. Microfilms Order No. 74-5157

An investigation was undertaken to determine: (1) the effect of ferrite content on general and stress corrosion cracking behavior of Type 304L stainless steel of a given overall composition and (2) the general and stress corrosion cracking behavior of GTA weldments made in two heats of Type 304L stainless steel. Stress corrosion cracking was studied using constant moment bend tests in boiling magnesium chlorides at 155 C while general corrosion behavior was studied using potentiostatic polarization tests, cathodic reduction, and passivation stability tests in 20% H2SO4. Results show that (1) austenite stabilizer composition signficantly affects HAZ microstructure and stress corrosion cracking, and (2) GTA weldments are significantly more resistant to stress corrosion cracking than the base metal. Dissert. Abstr.

N74-20067*# Boeing Aerospace Co., Seattle, Wash. Research and Engineering Div.
ACTIVE CLEANING TECHNIQUE FOR REMOVING CONTAMINATION FROM OPTICAL SURFACES IN SPACE Final Report
R. L. Shannon, R. B. Gillette, and G. A. Cruz Aug. 1973 75 p refs
(Contract NAS8-26385)
(NASA-CR-120172; D180-17610-1) Avail: NTIS HC $6.75 CSCL 06M

An active cleaning technique for removing contaminants from optical surfaces in space was investigated with emphasis on the feasibility of using plasma exposure as a means of in-situ cleaning. The major work accomplished includes: (1) development of an in-situ reflectometer for use in conjunction with the contaminant film deposition/cleaning facility; (2) completion of Apollo Telescope Mount (ATM) filter treatment experiments to assess the effects of plasma exposure on the UV transmittance; (3) attempts to correlate the atomic oxygen flux with cleaning rate; (4) completion of in-situ butadien contamination/plasma cleaning/UV reflectance measurement experiments; (5) carbon cleaning experiments using various gases; (6) completion of silicone contamination/cleaning experiments; and (7) experiments conducted at low chamber pressures to determine cleaning rate distribution and contamination of surfaces adjacent to those being cleaned. Author

N74-20068*# Hough Lab., Springfield, Ohio.
FURTHER DEVELOPMENT OF CHEMICAL VAPOR DEPOSITION PROCESS FOR PRODUCTION OF LARGE DIAMETER CARBON-BASE MONOFILAMENTS Contractor Report, May 1972 - May 1973
R. L. Hough and R. D. Richmond Feb. 1974 84 p refs
(Contract NAS3-15837)
(NASA-CR-121267) Avail: NTIS HC $7.25 CSCL 13H

The development of large diameter carbon-base monofilament in the 50 micron to 250 micron diameter range using the chemical vapor deposition process is described. The object of this program was to determine the critical process variables which control monofilament strength, monofilament modulus, and monofilament diameter. It was confirmed that wide scatter in the carbon substrate strength is primarily responsible for the scatter in the monofilament strength. It was also shown through etching experiments that defective substrate surface conditions which can induce low strength modular growth in the monofilament layers are best controlled by processing improvements during the synthesis of the substrate. Modulus was found to be linearly proportional to monofilament boron content. Filament modulus was increased to above 27.8MN/sq cm but only by a considerable increase in monofilament boron content to 60 wt. % or more. Monofilament diameter depended upon dwell time in the synthesis apparatus. A monofilament was prepared using these findings which had the combined properties of a mean U.T.S. of 398,000 N/sq cm, a modulus of 18.9 MN/sq cm (24,000,000 psi), and a diameter of 145 microns. Highest measured strength for this fiber was 451,000 N/sq cm (645,000 psi). Author

N74-20069# Bureau of Mines, Bartlesville, Okla. Energy Research Center.
WASTE LUBRICATING OIL RESEARCH: AN INVESTIGATION OF SEVERAL RE-REFINING METHODS
M. L. Whisman, J. W. Goetzinger, and F. O. Cotton 1974 29 p refs
(BM-RI-7884) Avail: NTIS HC $4.50

Several commercial processes for reclaiming used lubricating oil were duplicated on a laboratory bench scale. Laboratory tests were selected and in some instances modified to determine the physical properties of each oil produced. In addition, the hydrocarbon composition of some samples was determined using a liquid chromatographic technique, and compared with the composition of new oil in order to determine the severity of the re-refining additive package for further estimates of quality as determined by wear, corrosion, foaming, and oxidation stability tests. Additionally, several samples of commercially re-refined oil and new oil were obtained and physical properties were determined for comparative studies. Author

N74-20070*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
PARTS, MATERIALS, AND PROCESSES EXPERIENCE SUMMARY, VOLUME 1
Washington NASA 1973 337 p refs Supersedes NASA-CR-114391 2 Vol.
(Contract NAS2-6060)
(NASA-SP-6507-Vol-1; NASA-CR-114391) Avail: NTIS HC $7.50 CSCL 13H

The ALERT program, a system for communicating common problems with parts, materials, and processes, is condensed and cataloqued. Expanded information on selected topics is provided by relating the problem area (failure) to the cause, the investigations and findings, the suggestions for avoidance (inspections, screening tests, proper part applications), and failure analysis procedures. The basic objective of ALERT is the avoidance of the recurrence of parts, materials, and processed problems, thus improving the reliability of equipment produced for and used by the government. K.M.M.

N74-20071*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
METHOD OF FLUXLESS BRAZING AND DIFFUSION BONDING OF ALUMINUM CONTAINING COMPONENTS Patent Application
Aleck P. Featherston (LTV Aerospace Corp.) and Kent P. OKelly, inventors (to NASA) (LTV Aerospace Corp.) Filed 12 Mar. 1974

24 p Sponsored by NASA
(NASA-Case-MSC-14435-1; US-Patent-Appl-SN-450504) Avail: NTIS HC $4.25 CSCL 13H

A method of diffusion bonding and fluxless brazing of aluminum alloys is described. An aluminum containing surface is treated to remove the aluminum oxide coating and the oxide free surface is then coated with a sealer containing polymeric material. The polymeric material prevents permeation of oxygen to the oxide-free surfaces. The polymeric substance is vaporized during the bonding process, leaving a clean surface for fluxless brazing. NASA

N74-20072*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FIBER SEPARATING AND CLEANING METHOD AND APPARATUS Patent Application
Dan Padilla, inventor (to NASA) (Martin Marietta Corp.) Filed 12 Mar. 1974 8 p
(NASA-Case-LAR-11224-1; US-Patent-Appl-SN-450502) Avail: NTIS HC $4.00 CSCL 13H

A simple and inexpensive method and apparatus for separating, dispensing, and cleaning particulate material from individual fibers in fiber bundles is introduced. The apparatus, a perforated tube, is housed in a chamber in which a vacuum is drawn. An air jet is directed into one end of the tube and fiber bundles are fed into the jet which separates and pulls fibers into the tube. The tube retains the fibers while fiber fragments, undesirably short fibers, and particulate matter are drawn by the vacuum and resultant air flow out of the tube through its perforations to a suitable discharge. NASA

N74-20073*# National Aeronautics and Space Administration. Pasadena Office, Calif.
ULTRASONICALLY BONDED VALVE ASSEMBLY Patent Application
Richard J. Salvinski, inventor (to NASA) (TRW, Inc.) Filed 28 Sep. 1973 17 p Prepared for JPL
(Contracts NAS7-100; JPL-953029)
(NASA-Case-NPO-13360-1; US-Patent-APPL-SN-401920) Avail: NTIS HC $4.00 CSCL 13G

A valve apparatus which is bonded or welded to the seat and then released by the application of the same energy to the bond joint is described. The valve is capable of maintaining a fluid tight seal over a long period of time. The choice of materials for the valve member and the valve seat provides an adequate sealing bond with little adhesion of material when the bond joint is broken for opening the valve. The configuration of the valve and the materials used in the development are described. NASA

N74-20074# Centre d'Etude de l'Energie Nucleaire, Brussels (Belgium).
FABRICATION OF DISPERSION-STRENGTHENED FERRITIC STEEL TUBES
J. Noels, H. Massaux, and L. DeWilde Feb. 1973 15 p refs
(BLG-475) Avail: AEC Depository Libraries HC $3.00

The possibility of fabrication, on laboratory scale, of thin-walled tubes in oxide-dispersion-strengthened ferritic steels is described. These alloys are candidate cladding materials for fast breeder reactors and are prepared by powder-metallurgy techniques. Final dimensions of 6/5.2 mm have been obtained by cold drawing extruded hollows with 30/26 mm diameter. Author (NSA)

N74-20075# Battelle-Northwest, Richland, Wash.
TRIODE CATHODIC VACUUM ETCHER FOR THE LOW-VOLTAGE POLISHING AND ETCHING OF METALLOGRAPHIC SPECIMENS
H. W. Arrowsmith and R. P. Allen 13 Sep. 1973 19 p refs Presented at the Internatl. Metallography Soc. Symp. on Specimen Preparation for Metallography, Los Angeles, 23 Sep. 1973 Sponsored by AEC
(BNWL-SA-4806; Conf-730949-2) Avail: NTIS HC $3.00

A triode cathodic vacuum etcher has been developed that has a number of advantages over conventional diode etchers. The triode etcher can be operated at specimen voltages well below 1000 V(dc) to minimize mount deterioration and the danger of arcing to the etched surface. Etching voltage and current density can be independently varied so that high current densities can be used with low voltages to provide rapid etching rates while minimizing heating of the specimen. Also, redeposition of sputtered material on the etched surface is reduced because of the low operating pressure (less than 3 millitorr) of the triode system. At very low voltages (75 to 125 V(dc)) the etching rate is relatively insensitive to crystalline orientation and a polishing action is obtained. Details of the design and operation of a simple, inexpensive triode cathodic vacuum etcher are presented and its ion polishing and etching capabilities are illustrated for a variety of materials including copper, plutonium, samarium, and uranium oxide. Author (NSA)

N74-20076# Pennsylvania State Univ., University Park. Dept. of Statistics.
CHOICE OF MODEL FOR RELIABILITY STUDIES AND RELATED TOPICS, 2 Final Report, 1 Jan. - 31 Dec. 1977
Charles E. Antle and Lawrence A. Klimko Wright-Patterson AFB, Ohio ARL Oct. 1973 57 p refs
(Contract F33615-71-C-1169; AF Proj. 7071)
(AD-772775; ARL-73-0121) Avail: NTIS CSCL 14/4

Some questions concerning the uniqueness of the maximum likelihood estimates for the parameters in the Weibull distribution are considered. In some cases answers previously known are reviewed and in other cases new results are presented. In particular, it is shown that with the shape parameter known, the maximum likelihood estimates of the location and scale parameters exist and are unique. Also the case in which all three parameters are unknown is examined in detail. An evaluation of the test for exponential vs. Weibull distributions based upon the maximum likelihood estimate of the shape parameter is presented. It is shown that this test is nearly as powerful as any invariant test could be. The same problem is also considered when there is an unknown location parameter. Tables for obtaining lower confidence limits for the reliability when using a location and scale parameter exponential for a model are presented. (Modified author abstract) GRA

N74-20077# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MACHINE CONSTRUCTION HYDRAULICS: A REFERENCE MANUAL
T. M. Bashta 13 Nov. 1973 1027 p refs Transl. into ENGLISH of the book "Mashinostroitelnaya Gidravlika Spravochnoye Posobiye" Moscow, Mashinostr., 1972 p 1-671
(AF Proj. 7343)
(AD-772652; FTD-HC-23-1343-72) Avail: NTIS CSCL 13/7

The report presents the basic principles of the hydraulics of pipelines, the flow of fluid through capillary slits, and the theory of hydraulic impact in hydrosystems. The author examines the principles of the theory, design and calculation of pumps, hydroengines of various types and also instruments for the distribution of working fluid, safety and regulating devices, hydraulic accumulators and scanning systems. GRA

N74-20078# Army Foreign Science and Technology Center, Charlottesville, Va.
PLASTIC FLOW OF A METAL BROACHED BY A CLOSED SHARP CURVED DIE
Zh. A. Karapetyan and I. S. Volkov 20 Jul. 1973 12 p refs Transl. into ENGLISH from the book "Issled. Plast. Techeniya Metallov." Moscow, Nauka, 1970 p 92-97
(AD-772423; FSTC-HT-23-206-73) Avail: NTIS CSCL 13/8

Combined fields of slipping and velocity lines are studied for the case of piercing with a sharp, curved punch at low compressions. A formula is produced for calculation of the forces necessary to achieve the process of metal flow. The interval of compression in which the solution given is correct is determined. The dependence of the solution of the problem considering friction on the tool is demonstrated. GRA

N74-20079# Defense Documentation Center, Alexandria, Va.
EXPLOSIVE FORMING Report Bibliography, Dec. 1960 - Jul. 1973
Jan. 1974 173 p refs
(AD-773260) Avail: NTIS CSCL 13/8

The bibliography is comprised of 119 citations of unclassified reports dealing with explosive forming. Some of the topics included

are: High Energy Rate Forming, Material Forming, Pressure Welding, and Explosion Welding. The report includes surveys, and analytical and experimental studies on various aspects of explosive metalworking. Corporate Author-Monitoring Agency, Subject, Title, Personal Author, Contract, and Report Number Indexes are included. Author (GRA)

N74-20080# Horizons, Inc., Cleveland, Ohio.
DEVELOPMENT OF THERMALLY STABLE POLY (FLUOROALKOXYPHOSPHAZENE) TRANSMISSION SEALS FOR THE UH-1 HELICOPTER Final Report, 19 Jan. 1972 - 18 Aug. 1973
Kennard A. Reynard, Richard W. Sicka, John C. Vicic, and Selwyn H. Rose Sep. 1973 65 p refs
(Contract DAAG46-72-C-0073)
(AD-773652; AMMRC-CTR-73-41) Avail: NTIS CSCL 11A

The objective of this program was to develop poly (fluoroalkoxyphosphazene) compounds suitable for service (1100 hrs.) as UH-1 helicopter transmission shaft lip seals over the -65F to 230F range. Significant advances were made in compounding ((CF3CH2O)2PN-(HCF2C3F6CH2O)2PN)n copolymers to meet these objectives. Dynamic tests by National Seal Division of Federal-Mogul Corp. of molded ((CF3CH2O)2PN-(HCF2C3F6CH2O)2PN)n seal formations determined the seals to have over 1000 hours running life. These test results provide promising evidence of the suitability of poly (fluoroalkoxyphosphazenes) for service as UH-1 helicopter transmission seals. (Modified author abstract) GRA

N74-20300 National Bureau of Standards, Washington, D.C.
TECHNIQUES FOR RULING AND ETCHING PRECISE SCALES IN GLASS AND THEIR REPRODUCTION BY PHOTOETCHING WITH A NEW LIGHT-SENSITIVE RESIST
Raymond Davis and Chester I. Pope *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 809-846 refs Repr. from NBS Circ. No. 565, 26 Aug. 19-55 p 1-36 (For availability see N74-20250 11-23)
(NBS-Circ-565)

N74-20301 National Bureau of Standards, Washington, D.C.
DEVELOPMENT OF A PHOTORESIST FOR ETCHING DESIGNS IN GLASS
Chester I. Pope and Raymond Davis *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 847-850 refs Repr. from J. Res. Natl. Bur. Stand., v. 55, no. 3, Sep. 1955 p 139-142 (For availability see N74-20250 11-23)
(NBS-RP-2612)

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State.

N74-20081 Arizona Univ., Tucson.
THE LUNAR LASER RANGING POINTING PROBLEM Ph.D. Thesis
William Eugene Carter 1973 125 p
Avail: Univ. Microfilms Order No. 74-1993

The physical parameters that require measurement during the actual process of pointing are identified, and the general measuring techniques and instrumentation are examined. An attempt is made to arrive at reasonable estimates of currently technologically feasible accuracies in the measurement of these parameters yielding the uncertainties resulting from inadequacies of instrumentation. The analysis leads to the conclusion that it should be possible to limit the typical pointing uncertainty to 0.5 to 1.5 arc seconds using relative pointing methods. Extensive testing of a system developed at the AFCRL Lunar Laser Ranging Observatory verify the precision of relative pointing, but a lack of sufficient range data makes it impossible to infer the system accuracy. Dissert. Abstr.

N74-20082*# Sparcom, Inc., Alexandria, Va.
A FEASIBILITY STUDY FOR A REMOTE LASER WATER TURBIDITY METER
G. D. Hickman, A. H. Ghovanlou, E. J. Friedman, C. S. Gault, and J. E. Hogg [1974] 39 p refs
(Contract NAS1-12251)
(NASA-CR-132376) Avail: NTIS HC $5.00 CSCL 20E

A technique to remotely determine the attenuation coefficient (alpha) of the water was investigated. The backscatter energy (theta = 180 deg) of a pulse laser (lambda = 440 - 660 nm) was found directly related to the water turbidity. The greatest sensitivity was found to exist at 440 nm. For waters whose turbidity was adjusted using Chesapeake Bay sediment, the sensitivity in determining alpha at 440 nm was found to be approximately 5 - 10%. A correlation was also found to exist between the water depth (time) at which the peak backscatter occurs and alpha. Author

N74-20083# National Bureau of Standards, Boulder, Colo.
LASER INDUCED DAMAGE IN OPTICAL MATERIALS, 1973
Alexander J. Glass, ed. (Calif. Univ., Livermore. Lawrence Livermore Lab.) and Arthur H. Guenther, ed. (AFWL) Dec. 1973 285 p refs Proc. of The 5th Ann. Symp. on Laser Damage in Opt. Mater., Boulder, Colo., 15-16 May 1973; sponsored by ONR, Am. Soc. for Testing and Mater. and NBS
(NBS-SP-387; LC-73-600331) Avail: SOD HC $2.65 as C13.10:387

The proceedings of a conference on damage to optical materials caused by laser radiation are presented. The subjects discussed are: (1) damage at dielectric surfaces, (2) damage due to self-focusing, (3) damage to dielectric coatings, and (4) damage to mirrors and windows in the infrared region. Theoretical studies of the fundamental properties affecting the damage process are included. For individual titles, see N74-20084 through N74-20116.

N74-20084 National Bureau of Standards, Boulder, Colo.
LASER INDUCED DAMAGE IN OPTICAL MATERIALS, SUMMARY AND CONCLUSIONS
Alexander J. Glass and Arthur H. Guenther *In its* Laser Induced Damage in Opt. Mater., 1973 Dec. 1973 p VII-XXI refs (For availability see N74-20083 11-16)

Topics relating to laser induced damage in crystalline and non-linear optical materials, at dielectric surfaces, and in thin film coatings as well as discussions of damage problems in the infrared region due both to cw and pulsed irradiation are presented. In addition, several reports on the theoretical analysis of laser-materials interaction, relative to the damage process were given, along with tabulations of fundamental materials properties of importance in evaluation of optical material response to high power laser radiation. Several papers presented by title only are included within the proceedings for completeness. The proceedings represent the major sources of information in the field of laser induced damage in optical materials. Author

N74-20085 Advanced Research Projects Agency, Arlington, Va.
THE ARPA PROGRAM ON OPTICAL SURFACE AND COATING SCIENCE
C. Martin Stickley *In* NBS Laser Induced Damage in Opt. Mater., 1973 Dec. 1973 p 3-10 (For availability see N74-20083 11-16)

A research program to determine the surface damage effects produced by laser radiation on infrared window materials is reported. The influence of surface preparation on surface damage is analyzed. It is concluded that surface polishing procedures are fundamental to retaining surface integrity in high power laser beams. The requirements for anti-reflection coatings and protective coatings are examined. The optical properties of the protective coatings are defined. It is stated that the mechanical properties of the coatings must be moisture resistant, cleanable, and have good thermal contact with the substrate. Author

N74-20086 Sandia Labs., Albuquerque, N.Mex.
NONLINEAR REFRACTIVE INDEX MEASUREMENTS IN LASER MEDIA
A. Owyoung *In* NBS Laser Induced Damage in Opt. Mater., 1973 Dec. 1973 p 11-25 refs Sponsored by AEC (For availability see N74-20083 11-16)

The ellipse rotation technique to measure nonlinear refractive index changes in YAG and several laser glasses using a Q-switched

ruby oscillator amplifier is discussed. By time resolving the ellipse rotation signal it is possible to obtain all the information necessary to plot ellipse rotation versus input power in a single shot. This procedure introduced the capability to detect transient contributions which would interfere with the measurement. A small anisotropy is found in the third order nonlinear susceptibility of YAG. Author

N74-20087 National Bureau of Standards, Boulder, Colo.
SELF-FOCUSING IN YTTRIUM ALUMINUM GARNET AND OPTICAL GLASSES
Albert Feldman, Deane Horowitz, and Roy M. Waxler *In its* Laser Induced Damage in Opt. Mater., 1973 Dec. 1973 p 26-35 refs Sponsored in part by ARPA (For availability see N74-20083 11-16)

An analysis of damage threshold data in borosilicate crown glass, fused silica, and dense flint glass for linearly and circularly polarized radiation indicates that the Kerr effect is the dominant self-focusing measurement for 1.06 micron laser pulses with a 25 nanosecond temporal width. The calculated thermal effect is found to be larger than the electrostrictive effect, which is small. Self-focusing length measurements in yttrium aluminum garnet (YAG) are found to agree with theory. In YAG, the Kerr effect also dominates. Author

N74-20088 California Univ., Livermore. Lawrence Livermore Lab.
A RATIONAL DEFINITION OF INDEX NONLINEARITY IN SELF FOCUSING MEDIA
Alexander J. Glass *In* NBS Laser Induced Damage in Opt. Mater., 1973 Dec. 1973 p 36-41 refs Sponsored by AEC (For availability see N74-20083 11-16)

The index nonlinearity in self focusing media is reported in terms of a critical power for the medium. The principal results of self focusing theory are expressed in terms of the ratio of the total power in a Gaussian beam to the critical power for the medium. Mathematical models are developed to support the theoretical considerations. The procedure provides a convenient mnemonic device for estimating the importance of self focusing effects. Author

N74-20089 Los Alamos Scientific Lab., N.Mex.
SELF FOCUSING OF VERY POWERFUL LASER BEAMS
B. R. Suydam *In* NBS Laser Induced Damage in Opt. Mater., 1973 Dec. 1973 p 42-48 refs Sponsored by AEC (For availability see N74-20083 11-16)

The characteristics of self-focusing laser beams are discussed. Computer simulations at high power level show that it is some small portion of the beam which first collapses. This leads to the study of self-focusing as a problem in stability theory. The method can be applied to divergent beams and to any medium in which gain is a known function of field strength. The theory agrees well with computer experiments. The absolute limit to the intensity available from a glass laser is on the order of 10 to the 10th power watts per square centimeter. Author

N74-20090 University of Southern Calif., Los Angeles.
HOMOGENEITY REQUIREMENTS FOR MINIMIZING SELF FOCUSING DAMAGE
J. Marburger, R. Jokipii (Calif. Inst. of Tech.), A. J. Glass (Calif. Univ., Livermore. Lawrence Livermore Lab.), and J. Trenholme (Calif. Univ., Livermore. Lawrence Livermore Lab.) *In* NBS Laser Induced Damage in Opt. Mater., 1973 Dec. 1973 p 49-56 refs (For availability see N74-20083 11-16)

The theory of wave propagation in random media is generalized in a straightforward way to include the effects of self focusing. Simple solutions are obtained which show how the intensity fluctuations which are induced by random inhomogeneities grow catastrophically. These solutions can be used to obtain conditions on the homogeneity of the medium, and on the fluctuations in the incident beam, for elimination or reduction of catastrophic self focusing in the medium. Author

N74-20091 KMS Fusion, Inc., Ann Arbor, Mich.
SELF-FOCUSING AND SATURATION IN DISK AMPLIFIERS
K. A. Brueckner and J. E. Howard *In* NBS Laser Induced Damage in Opt. Mater., 1973 Dec. 1973 p 57-62 refs (For availability see N74-20083 11-16)

The methods of geometrical optics are used to investigate self-focusing in arbitrarily spaced neodymium glass disk amplifiers. Difference equations describing the growth of a localized ring or spot beam inhomogeneity are derived and solved numerically. The corresponding differential equations are solved in closed form for the case of equally spaced disks, yielding explicit constraints on the allowable amplitude and width of spikes in terms of the thickness and spacing of the disks. In a more refined calculation, the decrease in gain at large flux densities is taken into account. The analytic and numerical results are applied to a typical laser system. Author

N74-20092 Itek Corp., Lexington, Mass.
LOW SCATTER FINISHING OF OPTICAL ELEMENTS c23
William Barnes *In* NBS Laser Induced Damage in Opt. Mater., 1973 Dec. 1973 p 64-68 refs (For availability see N74-20083 11-16)

The adaptation of bowl-feed polishing techniques to the low-scatter finishing of large optical elements is described. Electron micrographs of the surface of a twenty-seven inch diameter fused silica spherical mirror indicate the possibility of successful superpolishing of large, high precision, optical elements. Photographs of the microstructure resulting from the polishing techniques are provided. Author

N74-20093 Owens-Illinois, Inc., Toledo, Ohio.
LASER SURFACE DAMAGE STUDIES ON SEVERAL GLASSES
N. L. Boling, G. Dube, and M. D. Crisp *In* NBS Laser Induced Damage in Opt. Mater., 1973 Dec. 1973 p 69-79 refs (For availability see N74-20083 11-16)
(Contract DAHC15-72-C-0170)

Q-switched laser induced surface damage studies on several glasses and sapphire are reported. By measuring thresholds on these various glasses, investigating the effect of various polishing compounds on damage of laser glass, studying damage morphologies, and taking care to detect damage in its initial stages, several conclusions are reached. Initial damage in practical situations is probably due to absorption by isolated submicron inclusions, and not electron avalanche. Inclusion type damage is found to occur without formation of the bright plasma associated with electron avalanche. The damage threshold is found to depend strongly on polishing compound in some cases. It is found that increased smoothness of a surface does not necessarily lead to an increased threshold. Author

N74-20094 Owens-Illinois Technical Center, Toledo, Ohio.
SOME ASPECTS OF SURFACE DAMAGE THAT CAN BE EXPLAINED WITH LINEAR OPTICS c23
M. D. Crisp *In* NBS Laser Induced Damage in Opt. Mater., 1973 Dec. 1973 p 80-83 refs (For availability see N74-20083 11-16)

Quantitative predictions of the relative values of surface damage thresholds for various geometries are found to follow from linear optics and simple assumptions concerning the damage mechanism. It is assumed that, for a fixed pulse shape, a surface will damage when it experiences an oscillating field of amplitude greater than a threshold value. This assumption is consistent with both absorption by inclusions and avalanche breakdown as a damage mechanism. The ratios of damage thresholds for entrance and exit surfaces at normal incidence, surfaces at Brewsters angle, and a total internal reflection surface are found to depend only on the index of refraction of the material. It follows from the analysis that the different threshold values obtained from measurements made with various geometries are simply related and contain information about only one intrinsic surface parameter. Author

N74-20095 Hughes Research Labs., Malibu, Calif.
DAMAGE IN LITHIUM IODATE WITH AND WITHOUT SECOND HARMONIC GENERATION
C. R. Giuliano and D. Y. Tseng *In* NBS Laser Induced Damage in Opt. Mater., 1973 Dec. 1973 p 84-90 refs (For availability see N74-20083 11-16)

An attempt was made to determine whether a significant difference exists between bulk damage thresholds under conditions of phase matching (PM) for second harmonic generation (SHG)

compared with the condition where phase matching is absent. Bulk damage in lithium iodate was studied both at 1.06 microns and 0.694 microns using single mode Q-switched lasers. Under the conditions of the experiment no significant difference was observed in damage thresholds between PM and non-Pm conditions for single shot damage at 0.694 microns both single pulse and 10 pps at 1.06 microns. Author

N74-20096 Bendix Research Labs., Southfield, Mich.
LASER SURFACE DAMAGE STUDIES AT BENDIX
P. Braeunlich, J. Carrico, B. Rosenblum, and A. Schmid *In* NBS Laser Induced Damage in Opt. Mater., 1973 Dec. 1973 p 91-102 refs (For availability see N74-20083 11-16)

A status report is presented which describes the application of the exoelectron imaging technique as a nondestructive test method for laser surface damage. The mechanism of exoelectron emission from dielectrics will be discussed and an outline of a theory of laser induced exoelectron emission will be given. It will be shown that thermally or optically stimulated electron emission images represent a record of physical phenomena that are precursors of laser surface damage. Experimental techniques used to obtain exoelectron images after laser exposure of the sample will be described and recent results presented. Author

N74-20097 Army Missile Command, Redstone Arsenal, Ala.
EFFECTS OF LASER FLUX ON GaAs
J. Lynn Smith *In* NBS Laser Induced Damage in Opt. Mater., 1973 Dec. 1973 p 103-106 refs (For availability see N74-20083 11-16)

An extension was made of surface damage threshold data to include damage at 10.6 microns. Surface damage thresholds ranged from about 8 MW cm/sq for 0.694 micron radiation to 30 MW cm/sq for 10.6 micron radiation, and except for 10.6 micron radiation did not depend significantly on whether the GaAs was p-type, n-type, or undoped. For 10.6 micron radiation, the p-type GaAs was damaged at one third the value for the n-type GaAs and mostly exhibited bulk cracking rather than surface damage. The damage threshold of GaAs shows some dependence on the 1.06 micron laser pulse time, becoming lower as the pulse duration increases. Highly localized damage sites occurring at 1.06 micron cannot be accounted for by laser beam inhomogeneities. A study of the effects of surface trash on this localization revealed that, although visible trash does play a role, it need not be present for surface pits of approximately 2 micron size to occur. An arrangement utilizing a Pockels-switched Nd(3+) glass laser and quartz transducer was devised to determine whether the leading acoustical pulse induced in undoped GaAs bulk by the laser beam was rarefaction or compression. The study confirmed that the main effect of the 1.06 laser beam is to produce a compression in the leading pulse. Author

N74-20098 Naval Research Lab., Washington, D.C.
CARRIER EFFECTS OBSERVED IN LASER-INDUCED DAMAGE IN A SILICON JUNCTION PHOTODETECTOR
John F. Giuliani *In* NBS Laser Induced Damage in Opt. Mater., 1973 Dec. 1973 p 107-113 refs (For availability see N74-20083 11-16)

Damage induced by a pulsed 1.06 micron laser was studied in a n-p-n silicon photodiode. The study was based on measured surface changes using a technique of He-Ne beam probing of the photoconductive gain and excess minority carrier diffusion lengths as functions of increasing cumulative pulsed laser energy. These preliminary studies suggest that the pulsed laser produces significant changes in the surface recombination rates for the charge carriers and this in turn can be related to the measured changes in detector gain and dark current also as functions of increasing laser energy. Author

N74-20099 University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
THE ROLE OF COATING DEFECTS IN LASER-INDUCED DAMAGE TO THIN FILMS
L. G. DeShazer, B. E. Newnam, and K. M. Leung *In* NBS Laser Induced Damage in Opt. Mater., 1973 Dec. 1973 p 114-123 refs Sponsored in part by ARPA (For availability see N74-20083 11-16)
(Contract F19628-71-C-0220)

Laser damage to dielectric thin film coatings was investigated using a TEM00 Q-switched ruby laser. The laser induced damage thresholds of several thin film coatings increased with decreasing laser beam spot size and were invariant for spot sizes greater than 150 microns. A simple model suggests that the distribution and nature of coating defects have played an important role in this spot size dependence, also, the probability of the laser beam striking a defect site will be greater for larger spot sizes, and that damage in materials can be distinguished as defect damage and intrinsic damage. This model can be also applied to surface damage. Author

N74-20100 Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass. Laser Physics Branch.
THE ROLE OF INCLUSIONS AND LINEAR ABSORPTION IN LASER DAMAGE TO DIELECTRIC MIRRORS
David Milam, R. A. Bradbury, and Michael Bass (Raytheon Res. Div., Waltham, Mass.) *In* NBS Laser Induced Damage in Opt. Mater., 1973 Dec. 1973 p 124-132 refs Sponsored in part by ARPA (For availability see N74-20083 11-16)
(Contract F19628-73-C-0127)

By studying the morphology of threshold damage and observing the predicted pulse duration-inclusion size relationship it was found that laser damage to dielectric coatings is primarily determined by the presence of metallic or highly absorbing nonmetallic inclusions. It is also shown that linear absorption does not determine the damage resistance of coatings when they are properly prepared from materials which do not show bulk absorption. Author

N74-20101 University of Southern Calif., Los Angeles. Dept. of Physics.
TIME RESOLUTION OF LASER-INDUCED DAMAGE TO THIN FILMS
N. Alyassini, J. H. Parks, and L. G. DeShazer *In* NBS Laser Induced Damage in Opt. Mater., 1973 Dec. 1973 p 133-137 refs Sponsored in part by ARPA (For availability see N74-20083 11-16)
(Contract F19628-71-C-0220)

The time evolution of laser induced damage to ZnS films was measured by monitoring the intensity of a He-Ne probe beam internally reflected from the films at the critical angle. The time behavior of the damage was measured with a resolution of 2 nsec, and was correlated to the ruby laser pulse and the spark emission, when present. This technique was used to compare the damage time evolution with the related damage site morphology observed in SEM photographs. Author

N74-20102 Northrop Corp., Hawthorne, Calif. Laser Technology Labs.
INVESTIGATION OF PULSED CO LASER DAMAGE IN COATED METAL MIRRORS AND DIELECTRIC-COATED WINDOWS
S. Holmes and P. Kraatz *In* NBS Laser Induced Damage in Opt. Mater., 1973 Dec. 1973 p 138-150 (For availability see N74-20083 11-16)

Results of some pulsed high power CO laser damage tests of metal coated metal mirrors and AR-coated CaF2 windows are reported. The laser employed in these tests is an E-beam pumped, CO gas laser which produces a multimode output pulse of approximatly 100 usec duration at a wavelength of 5 microms. It was focused to a spot size of 2 - 3 mm, yielding maximum energy densities in excess of 700Jsq/cm. The mirrors tested were polished beryllium copper substrates coated with either silver or gold; the windows were polished CaF2 having multilayer AR-coatings comprising combinations of ThF4, PbF2, MgF2, and MgO. Damage threshold measurements and effects of fabrication parameters on performance are discussed. Author

N74-20103 Hughes Research Labs., Malibu, Calif.
PULSED CO2 LASER DAMAGE STUDIES OF WINDOWS AND WINDOW COATINGS
A. I. Braunstein, V. Wang, M. Braunstein, J. E. Rudisill, and J. Y. Wada *In* NBS Laser Induced Damage in Opt. Mater., 1973 Dec. 1973 p 151-156 (For availability see N74-20083 11-16)
(Contract F29601-72-C-0132)

A study was made of damage thresholds and damage morphology for KCl, ZnSe, and CdTe windows subjected to a

pulsed CO2 TEA laser. Damage to KCl and CdTe was initiated at the surfaces while ZnSe windows were found to fail due to explosion of inclusions in the bulk. For As2S3 passivated KCl or ThF4/As2S3 antireflection coated KCl, or BaF2/ZnS antireflection coated ZnSe the damage morphology was the same as for uncoated windows - failure was not initiated by the coatings. For the two antireflection coating designs studied electric field distributions are shown, and their use in choosing between alternate designs is explained. Author

N74-20104 Hughes Research Labs., Malibu, Calif.
PULSED CO2 LASER DAMAGE STUDIES OF METAL AND DIELECTRIC COATED MIRRORS
V. Wang, A. I. Braunstein, M. Braunstein, J. E. Rudisill, and J. Y. Wada *In* NBS Laser Induced Damage in Opt. Mater., 1973 Dec. 1973 p 157-169 refs (For availability see N74-20083 11-16)
(Contract F29601-72-C-0132)

Damage thresholds measured using single transverse mode 10.6 microns radiation are reported for several metal and dielectric enhanced multilayer mirrors (CdTe/ThF4, ZnTe/ZnS, As2S3/KCl). Typical values are in the range of several J/sq cm for semiconductor thin films to over 30 J/sq cm for wide bandgap dielectric thin films. These single mode values are considerably lower than the corresponding multimode results. Scanning electron microscope, X-ray microprobe, and power dependent absorption measurements were performed in order to examine the nature of mirror surfaces before and after laser damage. Several models for potential damage mechanism (thermal, inclusion, dielectric, etc.) were investigated. A comparison of the experimental and theoretical results provided the basis for a possible damage model. Author

N74-20105 Laboratoires de Marcoussis (France).
DAMAGE THRESHOLD IN 10.6 MICRON LASER MATERIALS
J. Davit *In* NBS Laser Induced Damage in Opt. Mater., 1973 Dec. 1973 p 170-174 refs Sponsored by CEA (For availability see N74-20083 11-16)

Q-switched laser damage thresholds have been determined for three materials: Germanium (Ge), Potassium Chloride (KCl), and Sodium Chloride (naCl). A TEM sub oo mode CO2 laser with output at 10.6 micron wavelength and a 75 nsec pulse length was employed. For the three materials, the damage observed was surface damage. In the case of potassium chloride and sodium chloride, while the surface damage threshold was about the same as with germanium, the surface breakdown threshold was much lower. Results on anti-reflection coated materials are also reported. Author

N74-20106 Los Alamos Scientific Lab., N.Mex.
RADIATION INDUCED DAMAGE TO NaCl BY 10.6 MICRON FRACTIONAL JOULE, NANOSECOND PULSES
Walter H. Reichelt and Eugene E. Stark, Jr. *In* NBS Laser Induced Damage in Opt. Mater., 1973 Dec. 1973 p 175-180 refs Sponsored by AEC (For availability see N74-20083 11-16)

Fractional joule nanosecond pulses from the Los Alamos pulsed CO2 laser system were used to obtain preliminary breakdown data for optical quality NaCl. Both surface and bulk damage have been observed. Surface damage in some samples takes the form of a rectangular craze pattern. This pattern is at the surface and similar to that observed by Bastow, et al, in TiC irradiated with light pulses from a Q-switched ruby laser. Estimated thresholds for breakdown and damage patterns are given. Author

N74-20107 Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
A STUDY OF 10.6 MICRON LASER INDUCED DAMAGE IN ALKALI HALIDE CRYSTALS
H. Posen, J. Bruce, J. Comer, and A. Armington *In* NBS Laser Induced Damage in Opt. Mater., 1973 Dec. 1973 p 181-188 refs (For availability see N74-20083 11-16)

Laser induced damage at 10.6 micrometers is observed in alloy alkali halide single crystals of the ALQLOY composition (KCl sub 0.33 - KBR sub 0.67) and pure KCl, as a function of crystalline orientation. The effect of the step-wise increase in laser irradiation power is monitored by X-ray topographic techniques, Nomarski microscopy and electron microscopy of the replicated damage surface. The relationship of the damage threshold to the crystalline orientation is explained by invoking the critical resolved shear stress law for the rock salt crystal structure of the alkali halides. Author

N74-20108 Perkin-Elmer Corp., Wilton, Conn.
SURFACE AND COATING ABSORPTION MEASUREMENT WITH AN ALPHAPHONE c14
E. L. Kerr *In* NBS Laser Induced Damage in Opt. Mater., 1973 Dec. 1973 p 189-193 refs (For availability see N74-20083 11-16)

Optical elements and coatings for high power laser applications require low surface absorption. The Alphaphone provides an instrument for rapidly measuring surface absorption at laser wavelengths. Sensitivity is 0.00001 absorption with 10 W input and a noise bandwidth of 15 Hz. The total measuring time is a few minutes. Sensitivity down to 1.5 x 10 to the 7th power is achievable by decreasing the chopping frequency. In addition, sensitivity may be improved by signal averaging or by increasing the input power. Two surfaces of a window may be measured independently. Scattering has no significant effect. The sample to be tested forms one wall of a thin cell filled with air. The air is heated by a small fraction of the energy absorbed at the sample surface when it is illuminated by the laser beam. The resulting pressure rise is measured by a capacitance microphone. The absorption signals were recorded from two KRS-5 windows coated with anti-reflection coatings for 10.6 microns. The absorption was 1%, measured with signal-to-noise ratio of 1000. Author

N74-20109 Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass. Solid State Sciences Lab.
PHOTOELASTIC CONSTANTS OF INFRARED TRANSMITTING MATERIALS c23
Bernard Bendow and Peter D. Gianino *In* NBS Laser Induced Damage in Opt. Mater., 1973 Dec. 1973 p 194-201 refs (For availability see N74-20083 11-16)

Stress-induced birefringence may severely degrade or limit the optical performance of IR transmitting materials, especially in high power laser applications. The birefringence in a given material is predictable once the photoelastic tensor has been determined. A first-principles calculation is presented of the photoelastic constants p sub ij, employing a recent theory of Humphreys and Maradudin. For ionic crystals, a Born-Mayer interatomic potential is employed, while for semiconductors a Morse potential is employed. The p sub ij, are calculated for a wide variety of rocksalt- and zinc blende-type crystals, including alkali-halides, II-IV's and III-V's. The electronic contribution to the p sub ij, is found to dominate in most semiconducting crystals, so that dispersion in the transparent frequency regime is generally negligible. For ionic materials, however, dispersion can be important; values at 10.6 microns, for example, may differ from those in the visible by as much as 25% to 50%, even for the better potential laser window materials. Author

N74-20110 University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
CHECKS OF MULTI-PHONON ABSORPTION THEORY c23
Robert Hellwarth *In* NBS Laser Induced Damage in Opt. Mater., 1973 Dec. 1973 p 202-207 refs (For availability see N74-20083 11-16)
(Contract F19628-72-C-0275)

There is considerable uncertainty as to the accuracy of calculations to date of multiphonon absorption in infrared window materials. It is shown that such uncertainties can be checked by calculating various weighted integrals over frequency (frequency moments) of the imaginary part of the electrical susceptibility, to which the absorption coefficient beta (omega)/cm is related. Expressions are obtained for six moments, evaluating a moment of the 2-phonon contribution explicitly for an anharmonic pair-interaction model. This exact result reveals inaccuracies in the dependence of absorption on ion masses and temperature predicted by approximate theories. Author

N74-20111 Xonics, Inc., Van Nuys, Calif.
THEORY OF MATERIAL FAILURE IN CRYSTALS CONTAIN-

ING INFRARED ABSORBING INCLUSIONS c23

C. J. Duthler and M. Sparks *In* NBS Laser Induced Damage in Opt. Mater., 1973 Dec. 1973 p 208-216 refs (For availability see N74-20083 11-16)

(Contract DAHC15-73-C-0127)

Small amounts of macroscopic inclusions in or on the surface of infrared-transmitting materials (in some cases a fractional volume of 10 to the -7th power to 10 to the -8th power) increase the average value of the optical absorption coefficient beta and cause localized heating that could lead to material failure at high-power levels. The frequency dependence of beta ranges from increasing as omega squared, to independent of omega, to exponentially decreasing with omega. Temperature dependence ranges from independent of T, to increasing as T(p) in the high-temperature limit, where p is approximately 1-4 typically. Simple expressions for the absorption cross sections are used to derive expressions for beta for large inclusions of strong and weak absorbers and small inclusions of dielectric and metallic particles. Material failure resulting from local heating of inclusions is a far greater problem in high-intensity short-pulse systems than in low-intensity long-pulse or CW systems having the same average intensity. Microsecond pulses with energy densities as low as a few joules per square centimeter can cause material failure. Author

N74-20112 Army Missile Command, Redstone Arsenal, Ala.

SURFACE DAMAGE BY LASER INDUCED COLLECTIVE ELECTRON OSCILLATIONS

R. A. Shatas, L. M. Narducci, J. Lynn Smith, H. C. Meyer, and S. S. Mitra *In* NBS Laser Induced Damage in Opt. Mater., 1973 Dec. 1973 p 217-224 refs (For availability see N74-20083 11-16)

Recent experiments with high pressure infrared molecular lasers demonstrate that the surface damage of ancillary optical components is the performance limiting factor. Intensities of a few tens of MW/sq cm in the pulse regime of fractional microsec are sufficient to damage the optical components; this performance is considerably less than what one would expect from the analysis of the intrinsic dielectric strength. It is proposed that the principal damage mechanism is associated with the damping of collective electron oscillations which have been driven beyond the linear regime by resonant photon-plasmon interaction. If the mobility of the carriers in a typical optical component is sufficiently high (such as for example in GaAs), one can adequately model the collective behavior or the carriers by a collisionless plasma. Thus the threshold for instabilities can be calculated on the basis of the Vlasov equation. In particular, the threshold for parametric instabilities in GaAs illuminated by 10.6 micron radiation is shown to be of the order of 10000 V/cm which is in close agreement with recent experimental results. The mechanism responsible for producing the critical electron density is proposed to be field-assisted electron tunneling. The required tunneling probability for electric fields of the order of the instability threshold is attained if the energy separation of bound to free state is less than the crystalline bandgap. Author

N74-20113 Harvard Univ., Cambridge, Mass.

STUDIES OF INTRINSIC OPTICAL BREAKDOWN c23

David W. Fradin and Michael Bass (Raytheon Co., Waltham, Mass.) *In* NBS Laser Induced Damage in Opt. Mater., 1973 Dec. 1973 p 225-238 refs (For availability see N74-20083 11-16)

(Contracts N00014-67-A-0298-0006; F19268-70-C-0223; F19628-73-C-0127)

By using a ruby laser to induce damage in the alkali halides, frequency dispersion was observed in the relative breakdown fields. This dispersion, which was not apparent at 1.06 microns, provides insight into the development of the avalanche. A mode-locked Nd:YAG laser with output pulses of 300 to 15 ps duration was used to induce damage in NaCl, and the results were compared to Q-switched studies. It was found that the rms breakdown field increased by almost an order of magnitude to over 10 to the 7th power volts/cm as the pulse duration was reduced from 10 ns to 15 ps. This observation and measurements of the ratio of surface to bulk breakdown fields show that the intrinsic mechanisms for surface and bulk breakdown are identical. Finally the effect of crystalline disorder on the breakdown strength of solids was studied by measuring the intrinsic damage fields for a polycrystal, an alloy, and an amorphous insulator and comparing the results to the damage fields for the respective single crystals. Author

N74-20114 Hughes Research Labs., Malibu, Calif.

LASER-INDUCED SURFACE DAMAGE IN PROUSTITE (Ag3AsS3) AT 1.06 MICRON AND 0.694 MICRON

C. R. Giuliano and D. Y. Tseng *In* NBS Laser Induced Damage in Opt. Mater., 1973 Dec. 1973 p 239-249 refs Sponsored in part by AFAL and ARPA and AFCRL (For availability see N74-20083 11-16)

The results of a number of experiments on laser-induced entrance surface damage in proustite (Ag3AsS3) are presented. Morphology for pulsed and CW surface damage is discussed and illustrated. Damage at 1.06 micron where most of the work was done was studied with single pulse, repetitively pulsed, and continuous radiation; damage at 0.694 micron was studied with single pulses. It was found that the surface damage threshold at 1.06 micron is independent of pulse repetition rate from single pulse to 500 pps. Results of measurements taken for pulses of different duration are interpreted in terms of a thermal mechanism. Author

N74-20115 Naval Electronics Lab. Center, San Diego, Calif.

SPECTRAL EMITTANCE MEASUREMENTS ON SEVERAL CRYSTALLINE SAMPLES c23

D. L. Stierwalt *In* NBS Laser Induced Damage in Opt. Mater., 1973 Dec. 1973 p 250-253 ref (For availability see N74-20083 11-16)

Emittance spectra were obtained at 273 K and 373 K from 3 to 15 microns on several samples supplied by AFCRL. The specimens included KBr, CdTe, ZnSexTe1-x, ZnSe, and four samples of Pb-doped KCl. Values of absorption coefficient were derived from the emittance data. Curves of absorption coefficient versus wavelength are presented. Author

N74-20116 Rockwell International Corp., Thousand Oaks, Calif. Science Center.

A SENSITIVE INTERFEROMETRIC NULL METHOD FOR MEASURING STRESS-INDUCED BIREFRINGENCE c14

George Birnbaum and Earl Cory *In* NBS Laser Induced Damage in Opt. Mater., 1973 Dec. 1973 p 254-258 refs (For availability see N74-20083 11-16)

A sensitive apparatus for measuring induced birefringence utilizing a scanning Fabry-Perot interferometer excited by circularly polarized laser radiation was developed. Because of birefringence in the sample located within the interferometer, its resonance wavelengths for radiation polarized parallel and perpendicular to the direction of applied stress are different. The voltage on a Kerr cell properly oriented within the interferometer is adjusted to cancel the sample birefringence. The wavelength difference is observed by using the scanning interferometer as a spectrum analyzer and comparing the resonance curves associated with each polarization. The stress-induced birefringence in YAG, sapphire and fused silica at 0.633 microns in the temperature range 26 to 75 C has been measured. Author

N74-20117*# Computer Sciences Corp., Falls Church, Va.

HOLOGRAPHY: A SURVEY

David D. Dudley Washington NASA 1973 135 p refs (Contract NASw-2173)

(NASA-SP-5118; LC-73-600236) Avail: NTIS MF $1.45; SOD HC $1.70 CSCL 20E

The development of holography and the state of the art in recording and displaying information, microscopy, motion, pictures, and television applications are discussed. In addition to optical holography, information is presented on microwave, acoustic, ultrasonic, and seismic holography. Other subjects include data processing, data storage, pattern recognition, and computer-generated holography. Diagrams of holographic installations are provided. Photographs of typical holographic applications are used to support the theoretical aspects. Author

N74-20118*# National Aeronautics and Space Administration, Washington, D.C.

LASER SYSTEM WITH AN ANTIRESONANT OPTICAL RING Patent Application

Anthony E. Siegman, inventor (to NASA) (Stanford Univ.) Filed

2 Nov. 1973 22 p
(Grant NGL-05-020-103)
(NASA-Case-HQN-10844-1; US-Patent-Appl-SN-412080) Avail: NTIS HC $4.25 CSCL 20E

Various applications of an antiresonant ring, consisting of a beam splitter and a number of reflectors are discussed. With the beam splitter having a transmission coefficient equal to a reflection coefficient, an optical beam incident on the beam splitter along a first axis is split into two components which circulate around the ring in opposite directions and are recombined to reflect back the beam along the first axis, with none of the beam power being directed along a second axis. The ring can be used as part of the cavity of two otherwise independent lasers, with two separate laser mediums external to the ring, or with a multi-wavelength laser medium in the ring. NASA

N74-20119# Colorado Univ., Boulder. Dept. of Physics and Astrophysics.
CRITICAL SCATTERING OF LASER LIGHT BY THIN FLUID FILMS Progress Report
R. Mockler and W. OSullivan 1973 15 p refs
(Contract AT(11-1)-2203)
(COO-2203-2) Avail: NTIS HC $3.00

A close-space Fabry-Perot interferometer has been developed that contains the fluid under study between the mirrors. The interferometer-cell has been used to make the first successful measurement of the anomalous refractive index of a binary fluid mixture near its consolute critical point. The cell has also been used to determine the coexistence curve for a binary mixture and the associated critical index beta. Intensity autocorrelation spectroscopy of laser light scattered from Brownian particles suspended in a binary mixture has been used to study the effective shear viscosity of the fluid near its critical point. A theory has been developed that includes a momentum-dependent shear viscosity and takes into account effects due to surface interactions between the particles and the fluid. This theory explains the observations and is consistent with the results of earlier tracer-diffusion measurements in a critical mixture.
Author (NSA)

N74-20120# California Univ., Livermore. Lawrence Livermore Lab.
PROPAGATION OF ULTRASHORT LIGHT PULSES IN A LASER MEDIUM
E. A. Mishkin 25 Jul. 1973 32 p refs
(Contract W-7405-eng-48)
(UCID-16333) Avail: NTIS HC $3.75

The set of coupled Maxwell-Schroedinger equations that govern the propagation of ultrashort pulses through a nonlinear laser medium are solved analytically in the steady-state regime. The periodic energy exchange, between the intense passing electromagnetic field and the stationary aggregate of two level atoms, leads to doubly periodic Jacobian elliptic function solutions. Their modulus is a function of the characteristic time length of the system and the pulse amplitude. The physical properties of these steady-state solutions are considered. It is shown that there are, in essence, only four periodic pulse-train solutions sdu, ndu, cnu and dnu, u is the retarded time t-z/v referred to the characteristic time. Time and the length of the pulse are controlled by the steady population inversion density established from the outside. Two of these solutions expand with intensified optical pumping while the other two contract under the same conditions. Author (NSA)

N74-20121# Centre de Recherches en Physique des Plasmas, Lausanne (Switzerland).
LASER SCATTERING MEASUREMENTS ON A ROTATING MAGNETIC FIELD PINCH
Z. A. Pietrzyk, A. Heym, F. Hofmann, A. Lietti, P. Boulanger, and D. W. Ignat Aug. 1973 12 p refs
(LRP-65/73) Avail: AEC Depository Libraries HC $3.00

Previous investigations of a plasma subjected to a rotating magnetic field are extended to include data from laser light scattering. The electron temperature and density are measured in the center of the discharge as a function of time. The measurements are compared with a MHD model of the experiment. Author (NSA)

N74-20122# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
QUASI-STEADY STATE CO2-LASER WITH PULSE EXCITATION
I. F. Kanaev, E. P. Kruglyakov, and V. K. Malinovskii 30 Jan. 1974 11 p refs Transl. into ENGLISH from Zh. Prikl. Mekhan. Tekhn. Fiz. (Moscow), no. 5, Sep.-Oct. 1971 p 171-173
(AD-773899; FTD-HT-23-699-74) Avail: NTIS CSCL 20/5

A number of methods make it possible to obtain significant values of the population inversion in lasers in a CO2-N2-He mixture. In this research a laser model is described which is associated predominantly with pulse excitation of molecules in a discharge with a nonequilibrium emission of a supersonic jet in a vacuum. GRA

N74-20123# Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.
GASDYNAMIC AND KINETIC PHENOMENA IN CHEMICAL LASERS Annual Report, 28 Sep. 1972 - 27 Sep. 1973
J. G. Skifstad, C. M. Chao, and S. C. Park 15 Dec. 1973 25 p refs
(Contract DAAH01-73-C-0167; DA Proj. 1T6-62703-A-308)
(AD-773719; RK-CR-73-10) Avail: NTIS CSCL 20/5

The report summarizes the first year of a research effort to gain an improved understanding of the importance of gasdynamic and kinetic phenomena in chemical lasers. A survey of gasdynamic phenomena in chemical lasers was prepared and presented at the Fourth International Colloquim on Gasdynamics of Explosions and Reactive Systems, July, 1973, at La Jolla. The remainder of the activity, summarized in this report, comprised a study of rotational relaxation kinetics as they influence saturation and preparation of a bibliography on the optical properties of HF and DF. More general gaskinetic theories and possible reasons for interest in them with application to chemical lasers are also discussed. Author (GRA)

N74-20124# Mitre Corp., Bedford, Mass.
SCATTERING MODELING: INVESTIGATION OF SCATTERING BY ROUGH SURFACES
G. O. Sauermann and P. C. Waterman 17 Jan. 1974 78 p refs
(Contract F19628-73-C-0001; AF Proj. 7250)
(AD-773306; MTR-2762; AFAL-TR-73-334) Avail: NTIS CSCL 20/6

A combined theoretical and scaled laser experimental investigation has been carried out. An extensive literature survey revealed that because of various shortcomings, existing computational methods are not adequate to treat a reasonable range of problems of practical interest. Consequently, a new approach has been formulated which first computes reflection from a sinusoidal surface, then treats the random surface by Fourier synthesis. Results obtained so far suggest that, for the periodic surface, complexity and hence computer time are reduced as much as three orders of magnitude over existing methods, making feasible the subsequent Fourier synthesis step. Experimental measurements were made for a range of sample roughnesses using a 3 mW HeNe laser and were greatly facilitated by use of an integrating sphere, as well as a point probe. (Modified author abstract) GRA

N74-20125# Illinois Univ., Urbana. Dept. of Electrical Engineering.
E-BEAM AND OPTICAL PUMPING OF FAR IR MOLECULAR LASERS Final Report, 1 Oct. 1972 - 30 Sep. 1973
Paul D. Coleman Dec. 1973 45 p refs
(Grant AF-AFOSR-2154-72; AF Proj. 9768)
(AD-773363; UILU-ENG-73-2561; AFOSR-74-0066TR) Avail: NTIS CSCL 20/5

An experimental and theoretical investigation of electrically excited glow discharge CO2 lasers has resulted in new data on the electron excitation efficiency and the intrinsic V-V relaxation rates for the 10.6 and 9.6 micrometers laser transitions. Preliminary experimental results on the E-beam controlled CO2 laser are desirable. Experiments using both high power and low power CO2 lasers as excitation sources for the generation of far IR laser action are described. Subsequent research includes the discovery of over 100 new lasing transitions and the generation

of over 5 kW pulse power at 496 micrometers in CH3F.
Author (GRA)

N74-19798* Hughes Aircraft Co., El Segundo, Calif. Space and Communications Group.
TASK ONE REPORT: OPTICAL SYSTEM STUDY
In its Technology Forecasting for Space Communication Jun. 1973 61 p (For availability see N74-19796 11-07)
(SCG-20669R) CSCL 20E

N74-19801* Hughes Aircraft Co., El Segundo, Calif. Space and Communications Group.
TASK FIVE REPORT: LASER COMMUNICATIONS FOR DATA ACQUISITION NETWORKS
In its Technology Forecasting for Space Communication Jun. 1973 104 p (For availability see N74-19796 11-07)
(SCG-20706M) CSCL 20E

N74-20035 Rheinmetall G.m.b.H., Duesseldorf (West Germany).
DESCRIPTION OF AN ELECTRONIC LASER OPTICAL VIBRATION MEASUREMENT DEVICE [BESCHREIBUNG EINES ELEKTRONISCH-LASEROPTISCHEN SCHWINGUNGSMESSGERAETES]
Bornefeld *In* Inst. Franco-Allemand de Rech. Meas. Methods in Ballistics 1973 p 107-137 In GERMAN (For availability see N74-20028 11-14)

N74-20036 Etablissement d'Experiences Techniques, Bourges (France). Div. Mesures et Simulations.
THE UTILIZATION OF LASERS FOR THE MEASUREMENT OF SMALL ANGULAR DISPLACEMENTS [L'UTILISATION DES LASERS POUR LA MESURE DES PETITS ECARTS ANGULAIRES]
Delort *In* Inst. Franco-Allemand de Rech. Meas. Methods in Ballistics 1973 p 139-159 In FRENCH (For availability see N74-20028 11-14)

N74-20046 Institut Franco-Allemand de Recherches, St. Louis (France).
HOLOGRAPHIC MEASUREMENTS TO DETERMINE THE DISTRIBUTION AND THE SPEED OF PARTICLES OR CHIPS [MESURES HOLOGRAPHIQUE POUR DETERMINER LA REPARTITION ET LA VITESSE DE PARTICULES OU D'ECLATS]
H. Royer and F. Albe *In its* Meas. Methods in Ballistics 1973 p 303-313 refs In FRENCH (For availability see N74-20028 11-14)

N74-20273 National Bureau of Standards, Washington, D.C. Metrology Div.
HIGH SPEED HOLOGRAPHIC INTERFEROMETRY
A. T. Funkhouser and K. D. Mielenz *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 189 refs Repr. from Appl. Opt., v. 9, May 1970 p 1215-1570 (For availability see N74-20250 11-23)

N74-20358 Nagoya Univ. (Japan). Inst. of Plasma Physics.
LASER LIGHT SCATTERING FROM A TURBULENTLY HEATED PLASMA
K. Kondo *In its* The Record of Symp. on Plasma Diagnostics Dec. 1973 p 62-69 (For availability see N74-20350 11-25)

N74-20359 Nagoya Univ. (Japan). Dept. of Electronics.
RELATIVISTIC CORRECTIONS TO THE SPECTRUM OF SCATTERED LIGHT FROM A HIGH TEMPERATURE PLASMA
Kiyoshi Hayase and Takayoshi Okuda *In its* The Record of Symp. on Plasma Diagnostics Dec. 1973 p 70-75 refs (For availability see N74-20350 11-25)

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N74-20126*# Connecticut Univ., Storrs. Inst. of Materials Science.
INVESTIGATION OF SOLIDIFICATION IN ZERO-GRAVITY ENVIRONMENT; M553 SPHERE FORMING EXPERIMENT. PHASE C: EVALUATION OF SKYLAB SPECIMENS Phase C Report, 15 May 1972 - 15 Dec. 1973
Theo Z. Kattamis 4 Dec. 1973 43 p
(Contract NAS8-28734)
Avail: NTIS HC $5.25 CSCL 11F

Results on specimen evaluation and discussion of solidification behavior in each case are reported in the following order: (1) specimen SL-1.6, (2) specimen SL-2.8, (3) specimen SL-2.4, (4) specimen SL-1.10 and (5) specimen SL-1.11. Comparison is made with ground-processed specimens of similar composition, whenever pertinent and meaningful. Among the nondestructive evaluation methods the measurement of sphericity was conducted by micrometric and shadowgraphic techniques. The intricate shape of specimens in some cases appeared difficult to define. In measuring the density, liquid penetration inside cavities that outcrop on the surface was avoided by sealing off these cavities. Among the destructive evaluation methods the use of the Quantimet 720 required particular attention, because of the small difference in contrast between second phases and micropores. With regard to microporosity microvoids in the core of some specimens were so fine that X-ray microradiography had to be used. Author

N74-20127*# Martin Marietta Corp., Denver, Colo.
DEVELOPMENT AND FRACTURE MECHANICS DATA FOR 6Al-6V-2 Sn TITANIUM ALLOY Final Report
C. F. Fiftal and E. J. Beck Jan. 1974 97 p
(Contract NAS9-13599)
(NASA-CR-134209; MCR-74-43) Avail: NTIS HC $8.00 CSCL 11F

Fracture mechanics properties of 6Al-6V-2Sn titanium in the annealed, solution-treated, and aged condition are presented. Tensile, fracture toughness, cyclic flaw growth, and sustained-load threshold tests were conducted. Both surface flaw and compact tension-specimen geometries were employed. Temperatures and/or environments used were -65 F (220 K) air, ambient, 300 F (422 K) air, and room-temperature air containing 10 and 100% relative humidity. Author

N74-20128*# Cornell Univ., Ithaca, N.Y. Materials Science Center.
PERTURBATION THEORY OF STRUCTURE IN CLASSICAL LIQUID MIXTURES: APPLICATION TO METALLIC SYSTEMS NEAR PHASE SEPARATION Ph.D. Thesis
Robert Lloyd Henderson Jan. 1974 154 p refs Sponsored jointly by NASA and NSF
(NASA-CR-137980; Rept-2154) Avail: NTIS HC $10.75 CSCL 11F

The partial structure factors of classical simple liquid mixtures near phase separation are dicussed. The theory is developed for particles interacting through pair potentials, and is thus appropriate both to insulating fluids, and also to metallic systems if these may be described by an effective ion-ion pair interaction. The motivation arose from consideration of metallic liquid mixtures, in which resistive anomalies have been observed near phase separation. A mean field theory correction appropriate to 3 pair potential for the effects of correlated motions in the reference fluid is studied. The work is cast in terms of functions which are closely related to the direct correlation functions of Ornstein and Zernike. The results are qualitatively in accord with physical expectations. Quantitative agreement with experiment seems to turn on the selection of the hard core reference potential in terms of the metallic effective pair potential. It is suggested that the present effective pair potentials are

perhaps not properly used to calculate the metallic structure factors at long wavelength. Author

N74-20129*# Boeing Aerospace Co., Seattle, Wash. Research and Engineering Div.
EFFECT OF PROOF TESTING ON THE FLAW GROWTH CHARACTERISTICS OF 304 STAINLESS STEEL Technical Report, Jul. 1973 - Jan. 1974
R. W. Finger Mar. 1974 49 p refs
(Contract NAS3-17762)
(NASA-CR-134603; D180-18020-1) Avail: NTIS HC $5.50 CSCL 11F

The effects of proof overload frequency and magnitude on the cyclic crack growth rates of 304 stainless steel weldments were investigated. The welding procedure employed was typical of those used on over-the-road cryogenic vessels. Tests were conducted at room temperature with an overload ratio of 1.50 to determine the effect of overload frequency. Effect of overload magnitude was determined from tests where a room temperature overload was applied between blocks of 1000 cycles applied at 78 K (-320 F). The cyclic stress level used in all tests was typical of the nominal membrane stress generally encountered in full scale vessels. Test results indicate that judicious selection of proof overload frequency and magnitude can reduce crack growth rates for cyclic stress levels. Author

N74-20130*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTS OF LOW-PRESSURE AIR ON OXYGEN CONTAMINATION AND LITHIUM CORROSION OF A TANTALUM ALLOY, T-111, AT 980 AND 1260 C
Randall F. Gahn Washington Apr. 1974 24 p refs
(NASA-TN-D-7588; E-7640) Avail: NTIS HC $3.00 CSCL 11F

The effects were studied of low-pressure air on contamination and corrosion in the tantalum alloy T-111/lithium system at 980 and 1260 C. Capsules of T-111 containing lithium were exposed to six vacuum levels between 1 x 10 to the 8th power and 0.0003 torr by controlled air leakage into a vacuum system. Capsules exposed at 980 C and 0.0002 torr failed from intragranular oxidation. The remainder of the capsules completed the 96-hour tests. The depth of oxygen contamination was greater at 980 C than at 1260 C. Tests made at 0.0001 and 0.00001 torr levels caused large increases in the oxygen content of the T-111. Tests at 0.000001 torr or less produced no significant contamination. No lithium corrosion of the T-111 was observed under any of the conditions. Author

N74-20131# Dow Chemical Co., Golden, Colo.
SPECIMEN MOUNTING METHODS FOR METALLOGRAPHY
D. V. Miley and A. E. Calabra 1973 68 p refs
(RFP-2148) Avail: NTIS HC $5.50

The development of metallographic mounting methods is reviewed and several of the more common methods being used are discussed. Characteristic advantages and disadvantages are pointed out. Retention of sample edges for examination is essential in many investigations, and a separate section is devoted to the many techniques devised to achieve this goal. It is noted that there is a mounting technique available for virtually any type of specimen. NSA

N74-20132# California Univ., Berkeley.
STRUCTURE AND ELEVATED-TEMPERATURE PROPERTIES OF FERRITIC ALLOYS STRENGTHENED BY INTERMETALLIC COMPOUNDS Ph.D. Thesis
M. D. Bhandarker Sep. 1973 124 p refs
(Contract W-7405-eng-48)
(LBL-1858) Avail: NTIS HC $8.25

An investigation was conducted to develop high-temperature 1Ta-5Cr, 1Ta-7Cr, and 1Ta-Cr-0.5 Mo alloys using a dispersion of the Laves phase in a noncarbon-containing, body-centered-cubic iron matrix. An understanding and application of basic principles of materials science and the use of large amounts of information available in the literature were instrumental in the development of Fe-Ta-Cr alloys of the investigation. The phase transformations that occurred in the alloys, and the resulting microstructures were studied. The relations between mechanical properties and structure were also examined. Short-time tensile mechanical properties and long-time creep and stress-rupture tests were conducted on the alloys in which microstructural features were varied by changes in the heat-treating procedure. The mechanical properties were compared with those of several commercially available steels. NSA

N74-20133# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France).
CONTRIBUTION TO THE STUDY OF SOLID STATE DIFFUSION IN CONCENTRATED ALLOYS: A CASE STUDY OF THE Fe-Pd SYSTEM Ph.D. Thesis
J. P. Gomez Jaen 1973 221 p refs In FRENCH
(CEA-R-4518) Avail: AEC Depository Libraries HC $13.25

Solid state diffusion in the Fe-Pd system is examined. The study is limited to isobar and isothermal binary diffusion without chemical reaction between the constituent materials of the system. Data cover system phases, different methods used to measure coefficients of diffusion, and experimental techniques utilized in the study. Micrographs of the alloy system are included.
Transl. by E.H.W.

N74-20134# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.
DIFFUSION OF CHROMIUM IN TYPE 316 STAINLESS STEEL
A. F. Smith Jul. 1973 19 p refs
(RD/B/N-2625) Avail: AEC Depository Libraries HC $3.00

Chromium diffusion plays an important role in the oxidation behavior of stainless steels. In a study of the diffusion behavior of the principal constituents of Type 316 stainless steel used in AGR reactors, the lattice and grain-boundary diffusion coefficients of Cr-51 were measured. Lattice diffusion in the temperature range 750 to 1200 C is described. Grain-boundary diffusion in the temperature range 650 to 1000 C is given. Dislocation-pipe diffusion effects were observed on the near-surface concentration profile below 700 C and also at deep penetrations above this temperature. Author (NSA)

N74-20135# Centre National de la Recherche Scientifique, Vitry (France). Centre d'Etudes de Chimie Metallurgique.
EFFECT OF BATH CONSTITUTION AND INTERNAL STRESSES ON THE GENERATION OF CRACKS IN THE ELECTRODEPOSITED Ni-Mo ALLOYS
Quang Kinh Vu and E. Chassaing [1973] 14 p refs Presented at Symp. on Electroplating and 70th Event of the European Federation of Corrosion, Budapest, 7-11 May 1973
(CEA-Conf-2446; Conf-730566-1) Avail: AEC Depository Libraries HC $3.00

By means of proper composition of the sodium citrate bath and adequate cathode current density, crack-free Ni-Mo coating can be electrodeposited. The effect of current density on internal stress, chemical composition, and critical thickness of the Ni-Mo deposits are investigated. The stress rises quickly with the increasing molybdenum content in the deposits. The sulfamate bath gives higher current efficiency and larger critical thicknesses than the chloride or sulfate baths. The dependence of crack generation on experimental conditions and on some intrinsic parameters of the deposits is discussed. Author (NSA)

N74-20136# Argonne National Lab., Ill.
STRUCTURAL INTERPRETATION OF SHORT-RANGE
S. K. Das and G. Thomas (Calif. Univ., Berkeley. Lawrence Berkeley Lab.) 1973 13 p refs Presented at Intern. Symp. on Order-Disorder Transformations in Alloys, Tubingen, West Germany, 3 Sep. 1973 Sponsored by AEC
(Conf-730967-1) Avail: NTIS HC $3.00

The various structural models of short-range order in alloys are briefly reviewed. The success and limitations of structural models in interpreting diffuse scattering data are discussed. Particular emphasis is given on the systems for which the diffuse short-range-ordered maxima in the X-ray and electron diffraction patterns are noncoincident with the position of the superlattice reflections. The recent electron diffraction results on these systems suggest microdomains with different superstructures to be present in the short-range-ordered state. The justification for such multiple microdomain configurations is

discussed in the light of some recent theoretical developments.
Author (NSA)

N74-20137# Sandia Labs., Albuquerque, N.Mex.
MECHANICAL PROPERTIES OF SEVERAL PRODUCTS FROM A SINGLE HEAT OF TYPE 304 STAINLESS STEEL
H. E. McCoy, Jr. and R. D. Waddell, Jr. 1973 24 p ref
Presented at Winter Meeting of Am. Soc. of Mech. Engr., Detroit, 11 Nov. 1973 Sponsored by AEC
(Conf-731105-8) Avail: NTIS HC $3.25

Tensile and stress rupture tests were run on several products from a 90-ton heat of type 304 stainless steel. The yield stress of the products in the as-received condition varied from 26,500 to 57,200 psi at 75 F. There were significant differences between the strengths of various products and considerable variation for a single product due to nonuniform residual cold work. Reannealing 0.5 h at 2000 F resulted in yield stresses in the 25,000 to 27,000 psi range; only the properties of the hot-reduced tubing fell below this range. At a test temperature of 1100 F, the as-received products had yield stresses from 14,800 to 35,500 psi. Reannealing caused the yield stresses of all but three products to fall in the range 10,200 to 11,700 psi. Stress rupture tests at 1100 F on the reannealed products did not reveal significant variation in properties. Author (NSA)

N74-20138# Oak Ridge National Lab., Tenn.
ANALYSIS OF STRESS-STRAIN BEHAVIOR OF TYPE 316 STAINLESS STEEL
D. Fahr Nov. 1973 27 p refs
(Contract W-7405-eng-26)
(ORNL-TM-4292) Avail: NTIS HC $4.00

Engineering stress-strain curves of annealed, cold-worked, and aged type 316 stainless steel were analyzed qualitatively. Atom-defect interactions were related to work-hardening rates and tensile data on the basis of serrations occurring in such stress-strain curves. Three types of serrations have been identified. The effect of varying strain rate was studied by varying crosshead speeds from 0.002 to 2 in./min in room-temperature tests and tests at 650 C. Only at 650 C had the crosshead speed a significant influence on the ultimate tensile strength and uniform plastic strain; yield strength and elongation values varied little with strain rate. The effect of test temperature ranging from 450 to 650 C was studied on as-annealed, annealed and aged, 20% coldworked, and cold-worked and aged specimens. Specimens aged for 4000 h were tested at their aging temperatures. Long-term aging at 450 and 550 C had little or no effect on mechanical-property data of as-annealed specimens, but affected those of previously cold-worked specimens measurably. NSA

N74-20139# Manlabs, Inc., Cambridge, Mass.
EFFECT OF CYCLIC TRANSFORMATION TREATMENTS ON THE STRUCTURE AND MECHANICAL PROPERTIES OF STEELS Final Report
S. Andrew Kulin, K. Kreder, and L. Kaufman Oct. 1973 77 p refs
(Contract N00014-70-C-0039; NR Proj. 031-740)
(AD-773102) Avail: NTIS CSCL 11/6

The study was undertaken to evaluate the effectiveness of cyclic treatments on strengthening 4340, H-4 and L-2 steels. The experimental results obtained show that hardness, yield and ultimate tensile strengths increase with transformation cycling. Ductility was found to be effected slightly while fracture toughness parameters such as impact and slow bend energy and K sub Ic showed no degradation due to cycling. GRA

N74-20140# Ohio State Univ. Research Foundation, Columbus.
STRESS CORROSION CRACKING OF TITANIUM AND TITANIUM BASE ALLOYS IN AQUEOUS AND GASEOUS MEDIA Final Report, 1 Mar. 1972 - 30 Jun. 1973
F. H. Beck and M. G. Fontana Sep. 1973 84 p refs
(Contract F33615-72-C-1917; AF Proj. 7312)
(AD-773245; AFML-TR-73-268) Avail: NTIS CSCL 11/6

Oxygen was found to increase significantly the stress corrosion cracking susceptibility of titanium alloys to methanol and bromine environments and the initial exposure stage is highly sensitive to the presence of moisture which can absorb on the surface and provide a protective film of water. Cracking planes in single crystal specimens were affected by stress level, chemical factors, and specimen orientation. Depth profiles of hydrogen concentration by ion microanalyses were made of cathodically charged commercially pure titanium and titanium alloys and stress was found to be a factor in determining the tendency for absorption of hydrogen. The importance of anodic dissolution in the stress corrosion cracking process is considered and discussed in depth. (Modified author abstract) GRA

N74-20141# California Univ., Los Angeles. School of Engineering and Applied Science.
THE USE OF SMALL, PRE-CRACKED BEND SPECIMENS FOR QUALITY CONTROL PURPOSES
Alan S. Tetelman, John N. Robinson, and Isaac Roman Nov. 1973 48 p refs
(Contract DAHC04-69-C-0008)
(AD-773596; UCLA-ENG-7383; TR-12) Avail: NTIS CSCL 11/6

The difficulties involved in using valid ASTM K sub (Ic) specimens for quality control purposes are described. It is shown from tests on steels and titanium alloys that values of K sub (Ic) can be obtained at lower cost from small specimens. If fracture initiation occurs before general yield, K sub (Ic) can be determined from the load required to cause crack extension. If fracture occurs after general yield, K sub (Ic) can be determined from the critical plane strain crack tip opening displacement or from the notch root contraction. The effect of a steeply rising plane strain R-curve can be corrected by using a newly developed R-extrapolation technique. Simplified versions of the methods involved are described whereby small specimens can be used to determine whether a material satisfies specifications for quality control. These simplified versions require little or no calculation for quality control-testing once master nomographs have been drawn up. Author (GRA)

N74-20142# Defense Documentation Center, Alexandria, Va.
QUENCHING (COOLING) Report Bibliography, Jul. 1961 - Aug. 1973
Feb. 1974 294 p refs
(AD-773475) Avail: NTIS CSCL 11/6

The bibliography is a collection of references relating to the various techniques of quenching metals and alloys to optimize their properties. Corporate Author-Monitoring Agency, Subject, Title, and Personal Author Indexes are included. Author (GRA)

N74-20143# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HIGH STRENGTH STEELS
Ya. M. Potak 28 Dec. 1973 242 p refs Transl. into ENGLISH of the book "Vysokoprochnye Stali" 1972 p 1-208
(AD-773507; FTD-MT-24-498-73) Avail: NTIS CSCL 11/6

The monograph examines the achievements of mainly U.S.S.R.'s physical metallurgy in the area of high-strength structural and stainless steels. Their structure and heat treatment are described. Properties are given and features of the use of new types of high-strength steels are shown. Considerable attention is given to the different forms of brittle fracture and to means of preventing them. Practical recommendations are given on the application and technology of treating parts made of the high-strength steels. Author (GRA)

N74-20144# Army Missile Command, Redstone Arsenal, Ala. Ground Equipment and Materials Directorate.
MECHANICAL BEHAVIOR OF 18Ni (300) MARAGING STEEL DURING RAPID HEATING AND AT ELEVATED TEMPERATURES
C. W. Austin, Jr. 12 Dec. 1973 44 p refs
(DA Proj. 1T0-61102-B-32A)
(AD-773732; RL-73-10) Avail: NTIS CSCL 11/6

The mechanical behavior of 18Ni (300) maraging steel was determined in constant loading rate, short-time elevated temperature tensile tests at loading rates of 4000 to 400,000 psi/sec at temperatures from 75 to 1200F and in heating rate tests with concurrent constant loads equivalent to 25 to 85 percent of the room temperature yield strength for heating rates of 50 to 400F/sec. Results are discussed. (Modified author abstract) GRA

N74-20145# Ballistic Research Labs., Aberdeen Proving Ground, Md.
THE HUGONIOT OF 5083 ALUMINUM
George Hauver and Angelo Melani Dec. 1973 34 p refs
(DA Proj. 1W0-62113-A-659)
(AD-773669; BRL-MR-2345) Avail: NTIS CSCL 11/6

The Hugoniot of 5083 H 131 aluminum has been experimentally determined in the pressure range from 161 to 472 kilobars. Over this pressure range the shock velocity-particle velocity relationship was found to be linear. The optical and electrical techniques used for the measurements and the methods for data reduction are described. A revised Hugoniot for polymethyl methacrylate and an approximate Hugoniot for mica were required in the electrical technique and are included as appendixes.
Author (GRA)

N74-20146# Rockwell International Corp., Thousand Oaks, Calif.
DEFORMATION AND SOLID SOLUTION STRENGTHENING OF bCC TITANIUM-VANADIUM ALLOYS Annual Report, 1 Jun. 1971 - 31 Dec. 1973
N. E. Paton and J. C. Williams Jan. 1974 31 p refs
(Contract N00014-71-C-0363; NR Proj. 031-752)
(AD-773546; SC518.20AR) Avail: NTIS CSCL 11/6

The influence of oxygen on the strength and deformation behavior of Ti-40V single crystals containing various amounts of oxygen has been examined. The flow stress has been analytically separated into a thermally activated component (tau*) and an athermal component (tau sub mu). It is shown that tau* increases linearly with oxygen concentration (C), whereas tau sub mu increases as C to the 1/2 power. Oxygen also tends to reduce the tendency for planar slip by enhancing cross slip. The implications of these effects on the properties of bcc Ti alloys are discussed.
Author (GRA)

N74-20147# Dayton Univ. Research Inst., Ohio.
ENGINEERING DESIGN DATA FOR ALUMINUM ALLOY 7050-T73651 PLATE Technical Report, Jun. 1972 - Jul. 1973
Raymond E. Jones Aug. 1973 36 p refs
(Contract F33615-72-C-1282; AF Proj. 7381)
(AD-773559; UDRI-TR-72-33; AFML-TR-73-269) Avail: NTIS CSCL 11/6

Mechanical properties of aluminum alloy 7050-T73651 one-inch thick plate were determined and then compared to other high strength aluminum alloys. The fracture, fatigue crack growth, and stress corrosion properties and the flaw sensitivity index for the 7050-T73651 alloy were equal to or better than similar properties for other 7000 series aluminum alloys at similar strength levels. Conventional notched and smooth fatigue data indicated that the 7050-T73651 alloy had fatigue properties somewhat below those of 7049-T73, but equal to most other aluminum alloys. Environmental fatigue crack growth tests indicated that the crack growth rate was significantly accelerated by the presence of a 3.5 per cent sodium chloride solution environment. Changes in the specimen width were found to have an effect on the conditional fracture toughness values.
Author (GRA)

N74-20148# Army Materials and Mechanics Research Center, Watertown, Mass.
PLANE STRAIN FRACTURE TOUGHNESS (KIC) DATA HANDBOOK FOR METALS Final Report
William T. Matthews Dec. 1973 92 p refs
(DA Proj. 1T0-62105-A-349)
(AD-773673; AMMRC-MS-73-6) Avail: NTIS CSCL 11/6

A compilation of plane strain KIC data is presented for metals manufactured in the U.S.A. and Europe, including 50 steels, 21 titanium alloys, 38 aluminum alloys, and one beryllium material. The data corresponds to static loading in neutral laboratory environment. The effect of temperature is included in the tables along with the direction of testing, the form and size of the material, its composition and heat treatment, and the specimen type and size.
Author (GRA)

N74-20149# Syracuse Univ., N.Y. Dept. of Chemical Engineering and Materials Science.
THE RELATIONSHIPS BETWEEN THE TRANSFORMATION CHARACTERISTICS AND THE FRACTURE AND FATIGUE PROPERTIES OF TRIP STEELS Final Report
V. Weiss, K. Schroder, W. Sanford, H. Chandan, T. Konio, D. Lal, and M. Sengupta Dec. 1973 81 p refs
(Contract DAAG46-72-C-0177; DA Proj. 1T0-61102-B-32A)
(AD-773712; AMMRC-CTR-73-50) Avail: NTIS CSCL 11/6

The deformation - transformation characteristics and their relationships to static and fatigue properties were studied for a number of 9 Ni, 9 Cr, 4 Mo, 1 Mn and 13 Co, 2 Ni, 15 Cr, 5 Mo, 0.5 Mn, all 0.2 - 0.3 C type TRIP steels. Under room temperature monotonic tensile loading the TRIP steels tested deform linearly to a stress maximum which is followed by a sharp yield drop. No appreciable amount of martensite formation was detected during the linear portion, while rapid martensite formation occurs during Luder's band formation and spreading, thus supporting the suggestion that martensite transformation is strain nucleated. The notch tensile strength or toughness was found to be strongly temperature dependent. Fatigue crack growth rates were also found to be quite sensitive to austenite metastability. (Modified author abstract) GRA

N74-20150# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PECULIARITIES IN THE FORMATION OF AUSTENITE DURING THE QUICK HEATING OF COLD-WORKED STEEL KVH-42 (42 Kh2NGSM)
V. N. Gridnev, S. P. Oshkaderov, and A. M. Smirnov 17 Dec. 1973 21 p refs Transl. into ENGLISH from Metallofizika Izd-vo Naukova Dumka (Kiev), no. 40, 1972 p 37-45
(FTD Proj. 60107; FTD Proj. T74-01-10)
(AD-773881; FTD-MT-24-259-74) Avail: NTIS CSCL 11/6

The authors have studied the peculiarities of austenite formation during the rapid heating of deformed steel KVK-42. Diagrams were made of the isothermic formation of austenite in steel KVK-42 taken at different initial states. It was shown that the most favorable steel for heat treatment with induction heating is steel first subjected to cold plastic deformation. GRA

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N74-20151 Oklahoma Univ., Norman.
THE DENSITY OF STATES OF DISORDERED BINARY ALLOYS Ph.D. Thesis
Avner Zin 1973 101 p
Avail: NTIS Avail: Univ. Microfilms Order No. 74-2286

The density of states for disordered binary alloys is calculated using the tight binding approximation for a single band model in a cubic lattice. A new coherent potential scheme has been developed to calculate the change in the self energy operator as a function of concentration. A proper integration of this operator is used as a first step in an iteration process to solve the scattering problem exactly. The total scattering matrix is calculated by averaging over possible clusters where the probability of a given cluster's composition is a function of concentration. The cluster size used in this calculation is an atom and its nearest neighbors. The perturbing potentials introduced by replacing, at a single site, one type of atom with another are calculated self-consistently and are made to satisfy the perfect shielding requirement. A way is found to include in the Hamiltonian possible differences in the bandwidths of the two pure constituents and a relation between this difference and the total potential energy introduced by the impurities.
Dissert. Abstr.

N74-20152*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FABRICATION OF POLYPHENYLQUINOXALINE COMPOSITE ARTICLES BY MEANS OF IN SITU POLYMERIZATION OF MONOMERS Patent Application
Tito T. Serafini, Peter Delvigs, and Raymond D. Vannucci, inventors (to NASA) Filed 17 Dec. 1973 12 p

(NASA-Case-LEW-11879-1; US-Patent-Appl-SN-425362) Avail: NTIS HC $4.00 CSCL 11D

A process is described for impregnating and polymerizing in situ, on a substrate, equimolar amounts of aromatic or heterocyclic bis(orthodiamine). The reaction is carried out in situ on the substrate at room temperature or below. Final curing is then obtained by heating the impregnated substrate at temperatures above 300 C to yield a polymer with molecular weights of 5,000 to 1,000,000. The monomer solution is prepared by first mixing solutions of the bis(orthodiamine) and phenylglyoxal and applying the resulting solution to the substrate or by applying the solutions of starting materials, separately to the substrate. In a preferred embodiment, equimolar amounts of solutions of 4,4 prime-bis(phenylglyoxalyl) diphenyl ether and 3,3 prime, 4,4 prime tetraminobenzophenone are mixed and the resulting solution applied to graphite fiber wound on a mandrel, the solvent removed, and final cure carried out at a temperature of 315 C for 1-1/2 hours. NASA

N74-20153*# Little (Arthur D.), Inc., Cambridge, Mass.
DEVELOPMENT OF ELASTIC ELASTOMERIC FIBER Final Report, 1972 - 1973
J. T. Howarth, S. G. Sheth, K. R. Sidman, and F. S. Dawn Mar. 1974 38 p
(Contract NAS9-12815)
(NASA-CR-134213; ADL-74693) Avail: NTIS HC $5.00 CSCL 11E

Improvements are reported in the physical properties and manufacturing techniques for the elastic elastomeric fluorinated polymer fiber which was developed previously. Strengths of 1200 psi to 2400 psi, double those previously reported for the fluorinated polymers were attained without any sacrifice in elongation or flame retardancy. The fibers meet the 70% oxygen, 30% nitrogen at 6.2 psia flame resistant specification. This improvement was achieved through the use of a new curing system based on peroxide and maleimide. The manufacturing process was improved by developing special techniques for extruding the uncured fiber into filaments. The process produces 24 monofilaments at one time. About 25 pounds of 15-denier fiber can now be produced per 8-hour day, and, if necessary, the production rate can be increased by scaling up the equipment. Author

N74-20154*# Linguistic Systems, Inc., Cambridge, Mass.
THE COMPOSITION AND PRESSURES OF GASES IN OCCLUSIONS OF CERTAIN TEKTITES AND SILICA GLASSES
Yu. A. Dolgov, Yu. F. Pogrennyak, and N. A. Shugurova Washington NASA Nov. 1973 11 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 198, no. 1, 1971 p 202-205
(Contract NASw-2482)
(NASA-TT-F-14768) Avail: NTIS HC $4.00 CSCL 11B

A study of tektite, examining the composition and pressure of gases in occlusions of bediasite, Darwinian, and Libyan glasses is presented. Conclusion as to the origin of the gases is based on the differing compositions of the gases and base minerals, on the evident viscosity of the melt or re-melt stages, and on the pressure of the gases in the occlusions. Author

N74-20155*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STRESS-RUPTURE STRENGTH AND MICROSTRUCTURAL STABILITY OF W-Hf-C WIRE REINFORCED SUPERALLOY COMPOSITES
Donald W. Petrasek and Robert A. Signorelli 1974 32 p refs Presented at the Composite Reliability Conf., Las Vegas, 15-16 Apr. 1974; Sponsored by Am. Soc. for Testing and Mater.
(NASA-TM-X-71529; E-7931) Avail: NTIS HC $4.75 CSCL 17D

W-Hf-C/superalloy composites were found to be potentially useful for turbine blade applications on the basis of stress-rupture strength. The 100-and 1000-hour rupture strengths obtained for 70 volume percent fiber composites tested at 1090 C were 420 and 280 MN/sq m (61,000 and 41,000 psi). The investigation indicated that with better quality fibers, composites having 100- and 1000-hour rupture strengths of 570 and 370 MN/sq m (82,000 and 54,000 psi) may be obtained. Metallographic studies indicated sufficient fiber-matrix compatibility for long time applications at 1090 C for 1000 hours or more. Author

N74-20156*# Little (Arthur D.), Inc., Cambridge, Mass.
DEVELOPMENT OF SINGLE CRYSTAL CERAMIC FIBERS
John S. Haggerty Jan. 1974 24 p refs
(Contract NAS3-16784)
(NASA-CR-134605; ADL-75245) Avail: NTIS HC $4.25 CSCL 11D

Exploratory fiber growth and characterization studies were carried out with MgO, doped TiC and heavily Cr2O3 doped Al2O3 fibers during this program. Single crystal fibers were grown using a CO2 laser heated, floating zone fiber growth process which was developed principally under the sponsorship of NASA-Lewis. A unique high pressure growth chamber permitted MgO fibers to be grown from stoichiometric melts for the first time. Vaporization rates were suppressed with high oxygen partial pressures. Titanium carbide and Cr2O3 doped Al2O3 fibers were grown from hot pressed or sintered polycrystalline feed rods. The qualities of these fibers were below expectation due to materials processing or handling procedures. Author

N74-20157# Joint Publications Research Service, Arlington, Va.
RESEARCH ON MATERIALS FOR THE MANUFACTURE OF OPEN-CYCLE MHD GENERATOR ELECTRODES
G. V. Samsonov, V. M. Sleptsov, G. G. Gnesin, V. S. Fomenko, I. A. Podchernyayeva, Yu. K. Lapshov, G. M. Shegolev, Yu. P. Kukota, and E. P. Strashinin 29 Mar. 1974 16 p refs Transl. into ENGLISH from Issled. Mater. dlya MGDG Otkrytogo Tsikla (Kiev), 1971 p 393-409
(JPRS-61609) Avail: NTIS HC $4.00

Test results are presented of gas-permeable blown electrodes under model MHD conditions. Author

N74-20158# Oak Ridge National Lab., Tenn.
THORIUM CERAMICS DATA MANUAL. VOLUME 2: NITRIDES
S. Peterson and C. E. Curtis Oct. 1973 20 p refs Revised
(Contract W-7405-eng-26)
(ORNL-4503-Vol-2-Rev) Avail: NTIS HC $4.00

Physical, chemical, and mechanical properties of thorium nitrides, alone and in combination with other nitrides and other thorium compounds, are collected from the literature through January 1973. The thorium-nitrogen phase equilibrium is reviewed. Although mechanical property data are still sparse, recent physical and chemical characterization of ThN has confirmed its high metallic conductivity, furnished detail on hydrolysis and oxidation, and expanded the knowledge of the (Th,U)N and Th(C,N) systems. Author (NSA)

N74-20159# Brookhaven National Lab., Upton, N.Y.
INSULATING TAPE CHARACTERISTICS AT CRYOGENIC TEMPERATURES
A. Muller 1973 11 p refs Presented at Conf. on Elec. Insulation and Dielec. Phenomena, Varennes Quebec, Can., 29 Oct. 1973 Sponsored by AEC and NSF
(BNL-18213; Conf-731026-3) Avail: NTIS HC $3.00

Plastics selected for evaluation for insulation on the superconducting cable for power transmission were: addition polymers, polyolefins; addition polymers, fluorinated hydrocarbons; and condensation polymers. A demonstration model is under design for 69-kV system operation; the goal for the insulation is an operating stress of 250 V/mil. Literature values are given for dielectric loss for three temperatures at 60 Hz. In addition, the cost per 1000 feet of 1-inch wide by 0.005-inch thick tape is listed. The polyolefins are the least expensive, the fluorinated hydrocarbons are the most expensive, and the condensation polymers are intermediate in price. Polyethylene, polypropylene, and Teflon exhibit large plastic elongations and low elastic moduli. Polycarbonate, polysulfone, Nomex, Mylar, and other condensation polymers are materials that exhibit very high yield and tensile strengths. Nylon 6,6, Nylon 11, calendered Tyvek, and supercalendered Tyvek exhibit moderate values of the mechanical properties under investigation. NSA

N74-20160# Rensselaer Polytechnic Inst., Troy, N.Y. Materials Div.
THE RELATIONSHIPS OF STRUCTURE TO PROPERTIES IN GRAPHITE FIBERS, PART 2 Final Report, May 1971 - Apr. 1972
Russell J. Diefendorf and Edward w. Tokarsky Oct. 1973 70 p refs
(Contract F33615-70-C-1530; AF Proj. 7342)
(AD-773168; AFML-TR-72-122-Pt-2) Avail: NTIS CSCL 11/5

Three dimensional structural models of several different carbon fibers with different precursor bases and representing a wide modulus range have been developed. In addition, a larger variety of commercially available carbon fibers and the newer high performance organic fibers have been studied. Results from the individual characterizations indicate that increasing fiber modulus is accompanied by development of thicker, straighter, more cyrstalline, and better aligned ribbons of graphite. General studies indicate acrylonitrile polymers (PAN) fibers experience an inflection in density in the 30-50 Msi range while the density of hot stretched fibers is uniformly proportional to modulus. Modulus is directly proportional to preferred orientation in organic fibers, and compressive failure is caused by buckling of polymer chains. (Modified author abstract) GRA

N74-20161# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LUBRICATING SYSTEMS OF GAS TURBINE ENGINES
N. T. Domotenko and A. S. Kravets 10 Dec. 1973 149 p refs Transl. into ENGLISH of the book "Maslyanye Sistemy Gazoturbinnykh Dvigatelei" Moscow, Transport, 1972 p 1-94 (AF Proj. 3048)
(AD-773493; FTD-MT-24-665-73) Avail: NTIS CSCL 11/8

In the book the problems of the arrangement and exploitation of lubricating systems of aviation gas-turbine engines are presented. The working condition of oils and their basic physicochemical and performance properties are examined. The characteristics of petroleum and synthetic oils are given. The requirements for lubricating systems are indicated, and also their fundamental and assembly diagrams are described. The work of a single-circuit, two-circuit and shorted lubricating systems of contemporary aircraft is examined. The features of the operation of lubricating systems of helicopters are given and the parameters of which affect the height power factors of lubricating systems are examined. GRA

N74-20162# Denver Research Inst., Colo.
DYNAMIC OXIDATION MECHANISMS OF SELECTED RARE-EARTH-BASE ALLOYS Final Technical Report, 1 Mar. 1972 - 1 Dec. 1973
Charles E. Lundin 15 Jan. 1974 44 p refs
(Contract N00014-67-A-0394-0006; NR Proj. 092-542)
(AD-773938) Avail: NTIS CSCL 11/6

The dynamic oxidation of selected rare-earth elements and rare-earth-base alloys were determined for bulk powders by thermal analytic and calorimetric technique. The principal parameters established were the ignition temperature and relative combustion energy. Various oxidation mediums were studied; air, pure oxygen, and solid oxidizers. The effect of particle size of powders on ignition and combustion efficiency was established. The effect of the structural characteristics of the binary alloy systems on dynamic oxidation was analyzed. The general conditions under which the powders would or would not burn were found to be critical and were delineated. The alloy system that ignited with minimum energy was the cerium-iron system. One of the alloys was capable of spontaneous combustion in air at room temperature. Several other alloy systems with minimal ignition energy were the cerium-zinc and the cerium-thorium systems. The experimental alloy systems were compared under the same conditions of testing with a commercial incendiary alloy. The alloy composition consisted of Mischmetal - 4% Mg. It did not compare as well in properties as some of the above experimental alloy systems. (Modified author abstract) GRA

N74-20163# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
MULTIAXIAL RESPONSE OF ATJ-S GRAPHITE Final Report, 1 Jul. 1972 - 15 May 1973
Julius Jortner Oct. 1973 133 p refs
(Contract F33615-72-C-2047; AF Proj. 7381)
(AD-773836; MDC-G3581; AFML-TR-73-170) Avail: NTIS CSCL 11/2

Experiments to explore the fracture and deformation of ATJ-S graphite under multiaxial stresses are described. The program included additional fracture tests in biaxial tension at 2000F; an analytical evaluation of the applicability and limitations of biaxial test data; tests at room temperature under triaxial stress states to measure the effects of multiaxiality on strain; and some biaxial experiments at room temperature to further explore the nature of biaxial softening (the occurrence of unexpectedly large strains in biaxial tension). (Modified author abstract) GRA

N74-20164# Pennsylvania State Univ., University Park. Materials Research Lab.
GLASSY CARBONS, ALLOYS Semiannual Technical Report, 1 Jul. - 31 Dec. 1973
R. L. Walker, Jr. 28 Jan. 1974 39 p refs
(Contract DAHC15-71-C-0290)
(AD-773914) Avail: NTIS CSCL 11/2

Contents: Compositional and structural modification of glassy carbons; Spherulitic glassy carbon; Preparation of glassy carbon with open macroporosity and its infiltration; Preparation and characterization of binary carbon-based glasses by RF-sputtering. GRA

N74-20165# Illinois Inst. of Tech., Chicago.
FATIGUE CHARACTERISTICS OF GLASS REINFORCED PLASTICS Final Report, 7 Mar. 1966 - 31 Aug. 1973
Lawrence J. Broutman and James W. Dally Jan. 1974 8 p refs
(Contract DA-31-124-ARO(D)-443)
(AD-773620; AROD-5672-16-E) Avail: NTIS CSCL 11/4

The report summarizes the objectives of the research contract and lists the graduate students receiving financial support from this contract and the degrees which the students earned. Also, a list of publications resulting from this research is presented. Author (GRA)

N74-20166# TRW, Inc., Cleveland, Ohio.
DEVELOPMENT OF BORON (ON CARBON): ALUMINUM COMPOSITE Final Report, 29 Jun. - 31 Oct. 1973
Paul Melnyk and Istvan J. Toch Dec. 1973 38 p ref
(Contract DAAG46-73-C-0268; DA Proj. 1W1-62113-A-660)
(AD-773657; AMMRC-CTR-73-48) Avail: NTIS CSCL 11/4

The objective of the program was to develop the processing technique required to insure the production of sound Al-B composite sheet having improved flatness and tensile properties. Processing variables of time, temperature and pressure were evaluated using boron fibers on both carbon, B(C), and tungsten B(W), substrates. Property evaluation was carried out using multi-ply v/o B(C)-2024 Al composite panels. The composite panels were fabricated by the foil-filament array, vacuum hot diffusion bonding process. Composite characterization included dimensional inspection, radiography, ultrasonic C-scan, mechanical testing, metallography, SEM and flatness measurement. In the 50 v/o B(W)-2024 Al system (using 550 KSI filament) average longitudinal tensile strength of 250.2 KSI and average transverse tensile strength of 36.5 KSI were obtained. In comparison, the 50 v/o B(C)-2024 Al system (using 480 KSI filament) average longitudinal tensile strength of 234.8 KSI and average transverse tensile strength of 19.1 KSI were obtained. The relatively low transverse strength in the latter system is attributed to filament splitting. Author (GRA)

N74-20167# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE CREEP OF POLYMER MATERIALS (THEORY AND APPLICATION), (CHAPTERS 7, 8, 9 AND 10)
I. I. Bugakov 17 Jan. 1974 127 p refs Transl. into ENGLISH of the mono. "Polzuchest Polimernykh Materialov, Teoriya i Prilozheniya" (USSR), 1973 p 3-6, 171-271
(AD-773882; FTD-MT-24-330-74) Avail: NTIS CSCL 11/4

The book discusses creep of polymers, based on the principle of addition (superposition), which was proposed by Boltzmann for the description of the elastic imperfections of solids. The first part of the book discusses the nonlinear integral equations

of the isothermal theory. As a particular case there is considered the theory of creep of isotropic materials. The linear theory is set forth in the second part. This theory is extended into the area of nonlinear creep. In the third part of the book the general properties of the solution of the problems of nonlinear and linear theory of creep are discussed. Viscoelastic analogies and examples of the solution of concrete problems are given.
GRA

N74-20168# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COMBUSTION THEORY METHODS IN POLYMER MECHANICS
G. I. Barenblatt 30 Jan. 1974 20 p refs Transl. into ENGLISH of the mono. "Gorenie i Vzryv" USSR, 1972 p 15-23
(AD-773885; FTD-MT-24-573-74) Avail: NTIS CSCL 11/9
The connection that exists between the theory of combustion and the polymer mechanics is discussed, and a survey of investigations in which the approaches and methods of the combustion theory are applied to the problems of the deformation, destruction and flow of polymers is given. GRA

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

N74-20169 Ohio State Univ., Columbus.
SOME ASPECTS OF DIMENSIONALITY AND SAMPLE SIZE PROBLEMS IN STATISTICAL PATTERN RECOGNITION Ph.D. Thesis
Anil Kumar Jain 1973 95 p
Avail: Univ. Microfilms Order No. 74-3211
Existence of an optimum quantization complexity is discussed for independent measurements of arbitrary quantization. Results on perfect discrimination for independent and binary measurements were generalized. The effect of using maximum likelihood estimates on the recognition accuracy was also discussed. Necessary and sufficient conditions on class-conditional densities for perfect discrimination in the case of infinite sample size are described. These conditions are rather simple to evaluate. Necessary and sufficient conditions for perfect discrimination for independent measurements in the case of finite sample size and arbitrary estimates of unknown parameters are also considered.
Dissert. Abstr.

N74-20170*# Virginia State Coll., Petersburg. Dept. of Mathematics.
THE SOLUTION OF TRANSCENDENTAL EQUATIONS
K. M. Agrawal and Romeo Outlaw Aug. 1973 37 p refs
(Grant NGR-47-014-009)
(NASA-CR-137385) Avail: NTIS HC $5.00 CSCL 12A
Some of the existing methods to globally approximate the roots of transcendental equations namely, Graeffe's method, are studied. Summation of the reciprocated roots, Whittaker-Bernoulli method, and the extension of Bernoulli's method via Koenig's theorem are presented. The Aitken's delta squared process is used to accelerate the convergence. Finally, the suitability of these methods is discussed in various cases. Author

N74-20171*# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
ON THE DESIGN OF OPTIMAL INPUT SIGNALS IN SYSTEM IDENTIFICATION
A. A. Lopez-Toledo and Michael Athans Jan. 1974 27 p refs
(Grant NGL-22-009-124)
(NASA-CR-137383; ESL-P-529) Avail: NTIS HC $4.50 CSCL 12A
The problem of designing optimal inputs in the identification of linear systems with unknown random parameters is considered using a Bayesian approach. The information matrix, which is positive definite for the class of systems analyzed, gives a measure of performance for the system inputs. The computation of the optimal closed-loop input mappings is shown to be a nontrivial exercise in adaptive control. Deterministic optimal inputs are shown to be easily computable. Numerical examples are given. A Kalman filter is used to estimate the parameters. A necessary condition for the Kalman filter not to diverge when applying linear feedback is also given. Author

N74-20172*# Kanner (Leo) Associates, Redwood City, Calif.
NUMERICAL EXPERIMENTS ON INVERSION OF SCATTERING INDEX BY THE METHOD OF STATISTICAL REGULARIZATION
V. A. Gashko, L. S. Turovtseva, V. F. Turchin, and K. S. Shifrin Washington NASA Sep. 1973 18 p refs Transl. into ENGLISH from the publ. "Optika Okeana i Atmosfery" Leningrad, Nauka, 1972 p 94-103
(Contract NASw-2481)
(NASA-TT-F-14774) Avail: NTIS HC $4.00 CSCL 12A
A continuation of an earlier work on restoration of the spectrum of particle sizes by the method of statistical regularization is presented. A detailed study of the restoration of the particle distribution function with various errors in index, various areas of index sector angle used in inversion, and various forms of the distribution of function, in order to formulate optimal requirements for experimental measurements is discussed.
Author

N74-20173*# Kanner (Leo) Associates, Redwood City, Calif.
RECOGNITION ALGORITHM FOR OBJECTS DESCRIBED BY SETS OF FEATURE MEASUREMENTS
Yu. I. Zhuravlev, Ye. Karchenski, and M. Mikhalevich Washington NASA Mar. 1974 12 p refs Transl. into ENGLISH of "Algoritm Raspoznavaniya dlya Obyektov Zadavayemykh Naborami Kachestvennykh Priznakov", Russian report, 1973 9 p
(Contract NASw-2481)
(NASA-TT-F-15435) Avail: NTIS HC $4.00 CSCL 12A
A generalization of a recognition problem, in which the space of feature measurements for the objects to be discriminated is not a metric space, is considered. The classes, to which the classified objects are assigned, intersect and partial ordering relations are given for the sets of feature measurements and classes. An optimization problem is described which must be solved to obtain the best recognition algorithm for a given class of objects. This reduces the problem to finding a set of parameters that maximize a certain function. Partial ordering relations are derived for the classes. Author

N74-20174# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
HILBERT SPACE APPROACH TO THE QUANTUM MECHANICAL THREE BODY PROBLEM
J. Ginibre and M. Moulin Feb. 1974 88 p refs
(LPTHE-74/8) Avail: NTIS HC $7.50
The quantum mechanical three-body problem in n-dimensional space ($n > 3$) with pair potentials that decrease at infinity is studied. Only Hilbert space methods are used, in particular Kato's theory of smooth operators and Agmon's a priori estimates in weighted Hilbert spaces. Most of Faddeev's results are recovered. It is proven that the negative spectrum of H consists of isolated eigenvalues of finite multiplicities which can accumulate at zero and at the two-body thresholds from below. The positive singular spectrum is contained in a closed set which measures zero, and the wave operators are asymptotically complete. Author

N74-20175*# Analytical Mechanics Associates, Inc., Seabrook, Md.
ANALYTICAL TOOLS AND ISOLATION OF TOF EVENTS Final Report
H. Wolf Jan. 1974 23 p refs
(Contract NAS5-11992)
(NASA-CR-132946; AMA-74-5; AMA-73-45) Avail: NTIS HC $4.25 CSCL 12A
Analytical tools are presented in two reports. The first is a probability analysis of the orbital distribution of events in relation to dust flux density observed in Pioneer 8 and 9 distributions. A distinction is drawn between asymmetries caused by random fluctuations and systematic variations by calculating the probability of any particular asymmetry. The second article discusses particle trajectories for a repulsive force field. The force on a particle due to solar radiation pressure is directed along the particle's radius vector, from the sun, and is inversely

proportional to its distance from the sun. Equations of motion which describe both solar radiation pressure and gravitational attraction are presented. S.K.W.

N74-20176# RAND Corp., Santa Monica, Calif.
BRANCH-AND-BOUND AND HEURISTIC APPROACHES TO A SEQUENCING PROBLEM WITH TEAM-SIZE REQUIREMENTS
Louis W. Miller Jan. 1974 27 p refs
(P-5152) Avail: NTIS HC $4.50

The work describes the simplest type of static problem with variable team-size requirements. The problem has the following structure: Resources consist of m identical and interchangeable machines, with m> 1; and n jobs all available for simultaneous scheduling. Every job has a known processing time requirement, p sub j, and a prescribed team size, r sub j, that never exceeds m. If the attributes of job j are p sub j and r sub j, exactly r sub j machines must be assigned to job j for a continuous interval of length p sub j. Interruptions are not permitted. Good scheduling criteria are in terms of minimizing the average of completion times and/or the amount of time required to complete all n jobs. Author

N74-20177*# Houston Univ., Tex. Dept. of Mathematics.
PARTIAL DERIVATIVES FOR VARIOUS SCALER FUNCTIONS OF MATRICES
John Quirein Jul. 1973 12 p
(Contract NAS9-12777)
(NASA-CR-134216) Avail: NTIS HC $4.00 CSCL 12A

Theorems and their proof are given for the solution of partial derivatives for various scaler functions of matrices. A.L.

N74-20178*# Houston Univ., Tex. Dept. of Mathematics.
ON DIFFERENTIATING THE PROBABILITY OF ERROR IN MULTIPOPULAR FEATURE SELECTION
B. Charles Peters Feb. 1974 17 p refs
(Contract NAS9-12777)
(NASA-CR-134217; Rept-30) Avail: NTIS HC $4.00 CSCL 12A

A method of linear feature selection for n dimensional observation vectors which belong to one of m populations is presented. Each population has a known apriori probability and is described by a known multivariate normal density function. Specifically we consider the problem of finding a k x n matrix B of rank k (k < n) for which the transformed probability of misclassification is minimized. Providing that the transformed a posterior probabilities are distinct theoretical results are obtained which, for the case k = I, give rise to a numerically tractable formula for the derivative of the probability of misclassification. It is shown that for the two population problem this condition is also necessary. The dependence of the minimum probability of error on the a priori probabilities is investigated. The minimum probability of error satisfies a uniform Lipschitz condition with respect to the a priori probabilities. Author

N74-20179# National Research Council of Canada, Ottawa (Ontario).
AVERAGING IN SOME SYSTEMS OF ORDINARY DIFFERENTIAL EQUATIONS
D. D. Bainov 1974 13 p refs Transl. into ENGLISH from Matematichki Vesnik (USSR), v. 5, no. 20, 1968 p 53-62
(NRC-TT-1739) Avail: NTIS HC $4.00

Theorems supporting Volosov's suggestion of a general scheme of averaging in systems of differential equations which contain slow and fast multidimensional movements are developed. A.L.

N74-20180# Naval Ship Research and Development Center, Bethesda, Md.
THE CONVERGING FACTORS FOR THE FRESNEL INTEGRALS Final Report
John W. Wrench, Jr. and Vicki Alley Jun. 1973 110 p refs
(AD-772521; NSRDC-4102) Avail: NTIS CSCL 12/1

The theory of the converging factors for the Fresnel integrals is developed from that of the converging factors for the sine and cosine integrals, and is then applied to the calculation on a CDC 6700 system of tables of these factors and their reduced derivatives to about 35 decimal places. The factors were used in conjunction with appropriately truncated asymptotic series to produce appendixed 28-place tables of the Fresnel integrals S2(x), C2(x) and of the closely related rocket functions rr(x) and ri(x), for successive integer values of x from 1 through 70. An abridged 28-place table of S(x) and C(x), for x ranging from 1 through 6, is also included. Author (GRA)

N74-20181# Brown Univ., Providence, R.I. Div. of Applied Mathematics.
EXISTENCE OF OPTIMAL CONTROLS FOR CONTROL SYSTEMS GOVERNED BY NONLINEAR PARTIAL DIFFERENTIAL EQUATIONS
Marshall Slemrod 15 Jan. 1974 29 p refs
(Contract N00014-67-A-0191-0009; NR Proj. 041-397)
(AD-772729) Avail: NTIS CSCL 12/1

A theory of existence of optimal controls for control systems governed by nonlinear evolution equations in Banach space is presented. The main technique is to imbed the problem into the theory of nonlinear evolution equations as presented in another paper and make use of certain approximation theorems presented there. Applications to a nonlinear wave equation with control in the damping coefficient and a nonlinear conservation law model for highway traffic control are presented. Author (GRA)

N74-20182# Rice Univ., Houston, Tex. Aero-Astronautics Group.
MODIFIED QUASILINEARIZATION ALGORITHM FOR OPTIMAL CONTROL PROBLEMS WITH NONDIFFERENTIAL CONSTRAINTS. PART 1: THEORY
A. Miele, A. Mangiavacchi, and A. K. Aggarwal 1973 36 p refs 2 Vol.
(Grant AF-AFOSR-2185-72; AF Proj. 9749)
(AD-772559; AAR-112; AFOSR-73-2205TR) Avail: NTIS CSCL 12/1

The paper considers the numerical solution of optimal control problems involving a functional 1 subject to differential constraints, nondifferential constraints, and terminal constraints. The problem is to find the state x(t), the control u(t), and the parameter pi so that the functional is minimized, while the constraints are satisfied to a predetermined accuracy. (Modified author abstract) GRA

N74-20183# Rice Univ., Houston, Tex. Aero-Astronautics Group.
MODIFIED QUASILINEARIZATION ALGORITHM FOR OPTIMAL CONTROL PROBLEMS WITH NONDIFFERENTIAL CONSTRAINTS. PART 2: EXAMPLES
A. Miele, A. Mangiavacchi, and A. K. Aggarwal 1973 43 p refs 2 Vol.
(Grant AF-AFOSR-2185-72; AF Proj. 9749)
(AD-772560; AAR-113; AFOSR-73-2180TR) Avail: NTIS CSCL 12/1

In a previous paper, Miele, Mangiavacchi, and Aggarwal developed the modified quasilinearization algorithm for minimizing a functional subject to differential constraints, nondifferential constraints, and terminal constraints. In the report, several numerical examples are presented, some pertaining to the fixed-final-time case and some pertaining to the free-final-time case. Both equality constrained optimization problems and inequality constrained optimization problems are investigated. The numerical results show the rapid convergence characteristics of the modified quasilinearization algorithm. Author (GRA)

N74-20184# Rice Univ., Houston, Tex. Aero-Astronautics Group.
SEQUENTIAL GRADIENT-RESTORATION ALGORITHM FOR OPTIMAL CONTROL PROBLEMS WITH NONDIFFERENTIAL CONSTRAINTS. PART 1: THEORY
A. Miele, J. N. Damoulakis, and J. R. Cloutier 1973 47 p refs
(Grant AF-AFOSR-2185-72; AF Proj. 9749)
(AD-772561; AAR-109-Pt-1; AFOSR-73-2261TR-Pt-1) Avail: NTIS CSCL 12/1

The paper considers the numerical solution of optimal control problems involving a functional subject to differential constraints, nondifferential constraints, and terminal constraints. The problem is to find the state x(t), the control u(t), and the parameter pi

so that the functional is minimized, while the constraints are satisfied to a predetermined accuracy. The approach taken is a sequence of two-phase processes or cycles, composed of a gradient phase and a restoration phase. The gradient phase involves a single iteration and is designed to decrease the functional, while the constraints are satisfied to first order. The restoration phase involves one or several iterations and is designed to restore the constraints to a predetermined accuracy, while the norm of the variations of the control and the parameter is minimized. Author (GRA)

N74-20185# Rice Univ., Houston, Tex. Aero-Astronautics Group.
SEQUENTIAL GRADIENT-RESTORATION ALGORITHM FOR OPTIMAL CONTROL PROBLEMS WITH NONDIFFERENTIAL CONSTRAINTS. PART 2: EXAMPLES
A. Miele, J. L. Tietze, and J. R. Cloutier 1973 65 p refs
(Grant AF-AFOSR-2185-72; AF Proj. 9749)
(AD-772562; AAR-110-Pt-2; AFOSR-73-2262TR-Pt-2) Avail: NTIS CSCL 12/1

Miele, Damoulakis and Cloutier developed the sequential gradient-restoration algorithm for minimizing a functional subject to differential constraints, nondifferential constraints, and terminal constraints. In the report, several numerical examples are presented, some pertaining to the fixed-final-time case and some pertaining to the free-final-time case. Both equality constrained optimization problems and problems with bounded control are investigated. The numerical results show the rapid convergence characteristics of the sequential gradient-restoration algorithm. Author (GRA)

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N74-20186*# Wisconsin Univ., Madison. Space Science and Engineering Center.
A STUDY TO DEFINE METEOROLOGICAL USES AND PERFORMANCE REQUIREMENTS FOR THE SYNCHRONOUS EARTH OBSERVATORY SATELLITE
Verner E. Suomi, Robert J. Krauss, David Barber, Nadav Levanon, David W. Martin, David W. McLellan, Dhirendra N. Sikdar, Lawrence A. Sromovsky, Dale Branch, Dennis Heinricy et al
31 Jul. 1973 167 p refs
(Contract NAS5-21798)
(NASA-CR-132937) Avail: NTIS HC $11.50 CSCL 22B

The potential meteorological uses of the Synchronous Earth Observatory Satellite (SEOS) were studied for detecting and predicting hazards to life, property, or the quality of the environment. Mesoscale meteorological phenonmena, and the observations requirements for SEOS are discussed along with the sensor parameters. F.O.S.

N74-20187# National Weather Service, Silver Spring, Md.
NUMERICAL WEATHER PREDICTION ACTIVITIES: NATIONAL METEOROLOGICAL CENTER, SECOND HALF 1973
Apr. 1974 32 p refs
Avail: NTIS HC $4.75

The NWP activities of the NMC are summarized for the second half of 1973. Major efforts were directed toward converting the operational programs to the new IBM 360/195 computer system acquired by NOAA. Preliminary activities in the new hurricane modeling project are given, and results of the first VTPR test are discussed. Author

N74-20188*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ON EVALUATING COMPLIANCE WITH AIR POLLUTION LEVELS NOT TO BE EXCEEDED MORE THAN ONCE PER YEAR
Harold E. Neustadter and Steven M. Sidik 1974 20 p refs
Proposed for Presentation at the Ann. Meeting of Air Pollution Control Assoc., Denver, 9-13 Jun. 1974
(NASA-TM-X-71518; E-7762) Avail: NTIS HC $4.00 CSCL 13B

The adequacy is considered of currently practiced monitoring and data reduction techniques for assessing compliance with 24-hour Air Quality Standards (AQS) not to be exceeded more than once per year. The present situation for suspended particulates is discussed. The following conclusions are reached: (1) For typical less than daily sampling (i.e., 60 to 120 24-hour samples per year) the deviation from independence of the data set should not be substantial. (2) The interchange of exponentiation and expectation operations in the EPA data reduction model, underestimates the second highest level by about 4 to 8 percent for typical sigma values. (3) Estimates of the second highest pollution level have associated with them a large statistical variability arising from the finite size of the sample. The 0.95 confidence interval ranges from + or - 40 percent for 120 samples per year to + or - 84 percent for 30 samples per year. (4) The design value suggested by EPA for abatement and/or control planning purposes typically gives a margin of safety of 60 to 120 percent. Author

N74-20189# Finnish Meteorological Inst., Helsinki.
STATISTICAL SURFACE WIND PREDICTION IN FINLAND
Antti Lange Sep. 1973 23 p refs
(TR-6; ISBN-951-697-018-4) Avail: NTIS HC $4.25

A combined method of dynamic and statistical systems is described which is used for automated weather forecasting in Finland. The method handles vector quantities statistically, using simultaneous and iterative regression techniques. Results are given from two experimental applications on local and regional wind forecasts. K.M.M.

N74-20190# Finnish Meteorological Inst., Helsinki.
A PARTICLE-IN-CELL METHOD FOR CALCULATING LONG RANGE TRANSPORT OF AIRBORNE POLLUTANTS
Goeran Nordlund Sep. 1973 20 p refs
(TR-7; ISBN-951-697-020-6) Avail: NTIS HC $4.00

A particle-in-cell method for the numerical calculation of airborne pollutant transport over long distances is presented. A difference scheme is used for computing the advective transport in order to eliminate pseudo-diffusion errors. Calculation of the spread of SO2 over north-western Europe within two days is given as an example of the application of the method and the estimated concentrations over Finland are compared with actual observations. Author

N74-20191# Finnish Meteorological Inst., Helsinki.
CLIMATOLOGICAL DATA FROM JOKIOINEN AND SODANKYLAE OBSERVATORIES, 1971
1973 47 p refs In FINNISH and ENGLISH
Avail: NTIS HC $5.50

A summary is presented of the meteorological observations made by the Jokioinen and Sodankyla observatories in 1971. The data include: values of the atmospheric pressure, temperature and relative humidity at even hours, the hourly mean values of the wind direction and wind speed, the amount of clouds, cloud formation and cloud height, hydrometeors observed with time of appearance, precipitation, visibility and snow depth. Author

N74-20192# Ionospharen-Institut Breisach (West Germany).
IONOSPHERE DATA, VERTICAL-ECHO-SOUNDING: FREIBURG, URSI-CODE 31, DECEMBER 1973 [IONOSPHAEREN-DATEN, VERTIKAL-ECHO-LOTUNG: FREIBURG, URSI-CODE 31, DEZEMBER 1973]
Dec. 1973 43 p ref In GERMAN and ENGLISH
(Rept-330-F) Avail: NTIS HC $5.25

Daily summaries are presented for vertical echo sounding of the upper atmosphere during December 1973. The data include charts of median values for the E- and F- regions. Author

N74-20193# Finnish Meteorological Inst., Helsinki.
CLIMATOLOGICAL DATA, 1972
1973 115 p refs In FINNISH and ENGLISH
Avail: NTIS HC $8.75

Daily meteorological observations from 12 stations in Finland and the monthly and annual summaries from 154 stations are presented. The following meteorological parameters are measured: temperature, precipitation, depth of snow, air pressure,

relative humidity, wind direction and speed, state of ground surface at 08 hours, amount of cloud cover at particular hours, visibility, and weather phenomena. S.K.W.

N74-20194*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SATELLITE VIEWS OF HURRICANE CAMILLE
William E. Shenk and Edward B. Rodgers (Environmental Res. and Tech., Inc.) Washington Apr. 1974 82 p refs
(NASA-TN-D-7547; G-7405) Avail: NTIS HC $4.00 CSCL 04B

Three periods within the life cycle of Hurricane Camille (1969) are studied with radiometric and camera measurements from Nimbus-3 and camera information from ATS-3 in conjunction with conventional information. These periods are the deepening phase, the interaction of Camille with midlatitude westerlies, and the excessive rain producing period when the cyclone was over the central Appalachian Mountain. Just prior to significant deepening, the Nimbus-3 Medium Resolution Infrared Radiometer (MRIR) showed that a pronounced feeder band had formed southeast of the center which was associated with the rapid transport of moisture into the storm circulation. During the rapid deepening phase the MRIR measurements indicated the development of large scale subsidence throughout the troposphere northwest of the center. When Camille was over the lower Mississippi Valley it acted as an obstruction to the envrionmental wind. A region of widespread subsidence was created west and north of the cyclone center. Increased cloud-top elevations, back to the levels reached when Camille was an intense cyclone over the Gulf of Mexico, were estimated from the Nimbus-3 High Resolution Infrared Radiometer (HRIR) measurements on August 20, 1969, when Camille produced rains of major flood proportions near the east slopes of the Appalachians in central Virginia. Author

N74-20195# RAND Corp., Santa Monica, Calif.
THE DISPLAY OF DIGITAL WEATHER DATA IN A COLORED IMAGE FORMAT
Jeannine V. Lamar and Roy H. Stratton Nov. 1973 14 p refs
(P-5139) Avail: NTIS HC $4.00

A general global circulation model for the numerical simulation of climate is described. The model assumes a grid over the earth of 72 five-deg divisions of longitude, and 46 four-deg divisions of latitude. Initial and boundary conditions are input to the program from which the global weather conditions are calculated by integrating primitive equations of motion. A FORTRAN program accesses these data, manipulates them, and generates a series of subroutine calls which create weather maps. Maps of total cloudiness generated for different contours are included. F.O.S.

N74-20196# Japan Meteorological Agency, Tokyo.
AEROLOGICAL DATA OF JAPAN, FEBRUARY 1973
1973 287 p refs
Avail: NTIS HC $17.50

Daily upper air data corrected for temperature error and curavature of the earth, are presented for Japan and its vicinity. The tables include standard pressure levels, temperature and humidity levels, wind levels, pilot-balloon data, and rocketsonde data. Author

N74-20197# Japan Meteorological Agency, Tokyo.
AEROLOGICAL DATA OF JAPAN, MARCH 1973
1973 341 p refs
Avail: NTIS HC $20.25
For abstract, see N74-20196.

N74-20198# Japan Meteorological Agency, Tokyo.
AEROLOGICAL DATA OF JAPAN, APRIL 1973
1973 307 p refs
Avail: NTIS HC $18.50
For abstract, see N74-20196.

N74-20199# Japan Meteorological Agency, Tokyo.
AEROLOGICAL DATA OF JAPAN, MAY 1973
1973 315 p refs
Avail: NTIS HC $18.75
For abstract, see N74-20196.

N74-20200# Japan Meteorological Agency, Tokyo.
AEROLOGICAL DATA OF JAPAN, JUNE 1973
1974 321 p refs
Avail: NTIS HC $19.25
For abstract, see N74-20196.

N74-20201# Japan Meteorological Agency, Tokyo.
AEROLOGICAL DATA OF JAPAN, JULY 1973
1974 327 p refs
Avail: NTIS HC $19.50
For abstract, see N74-20196.

N74-20202# Japan Meteorological Agency, Tokyo.
AEROLOGICAL DATA OF JAPAN, AUGUST 1973
1974 320 p refs
Avail: NTIS HC $19.00
For abstract, see N74-20196.

N74-20203# Japan Meteorological Agency, Tokyo.
AEROLOGICAL DATA OF JAPAN (CHICHIJIMA AND MINAMITORISHIMA) JUNE 1968 - APRIL 1969
Apr. 1969 111 p refs
Avail: NTIS HC 8.75
For abstract, see N74-20196.

N74-20204# Naval Weapons Center, China Lake, Calif.
PROJECT FOGGY CLOUD 5, PANAMA CANAL WARM FOG DISPERSAL PROGRAM Technical Publication, Aug. - Dec. 1972
R. S. Clark, T. L. Wright, R. W. Evert, R. B. Loveland, and R. E. Northup, Jr. Dec. 1973 93 p refs
(AD-773473; NWC-TP-5542) Avail: NTIS CSCL 04/2

In 1972 experiments were conducted along the Gaillard Cut to test a number of different means of dispersing and suppressing fog. Among the techniques tested were helicopter and fixed-wing aircraft seeding of fogs with various fog-dispersal agents, ground-based seeding with various agents, and fog suppression by spreading monomolecular films on the canal surface. Also, tropical cumulus cloud characterization data were collected. Several techniques proved promising enough to warrant further investigation and development. Most promising for the canal area was the suppression of fog by monomolecular films. Also promising were airborne seeding with glycerine and ground-based seeding with charged bubbles. GRA

N74-20205# Naval Research Lab., Washington, D.C.
THE NRL AIR MONITORING STATION
A. Stamulis, R. C. Taylor, and V. R. Piatt Dec. 1973 13 p
(AD-773411; NRL-MR-2699) Avail: NTIS CSCL 13/2

The NRL Air Monitoring Station was constructed for the purpose of housing instruments necessary for measuring various air pollutants of the ambient atmosphere. It houses instruments for measuring low concentrations of sulfur dioxide, ozone, nitrogen dioxide, methane, carbon monoxide, and total hydrocarbons. These instruments are automatic, real time, continuous analyzers using the most modern principles of physical and chemical methods of analysis. The instruments analyze air from a continuous flow of air through a three-inch diameter sampling manifold which projects eight feet above the roof of the building. (Modified author abstract) GRA

N74-20206# GEOMET, Inc., Rockville, Md.
A TWO-DIMENSIONAL WARM FOG MODIFICATION MODEL Final Report
Demetrios J. Moschandreas, Roland T. Chu, and Scott D. Thayer 31 Dec. 1973 97 p refs
(Contract N00014-70-C-0371; NR Proj. 082-253)
(AD-773637; GEOMET-EF-295) Avail: NTIS CSCL 04/2

The purpose of this five-year-long study is two-fold: (1) to perform the necessary research to examine and evaluate physical processes that are important in the formation and dissipation of warm fog and stratus, relate them to the number, and type of condensation nuclei in the atmosphere, and relate them in turn, to pollution and its products; and (2) to conduct research to determine the effects of pollution on the condensation nuclei

that are responsible for formation of ocean and cumulus clouds. GRA

N74-20207# Naval Academy, Annapolis, Md. Dept. of Environmental Sciences.
ON THE INTENSITY OF HURRICANES IN RELATION TO THE SEA'S TEMPERATURE
Hugh E. Willoughby 15 Nov. 1973 12 p refs
(AD-773759; ES-2) Avail: NTIS CSCL 04/2

The minimum hydrostatic pressure attainable through tropospheric warming associated with saturated adiabatic ascent in tropical cyclones was computed by an iterative numerical process. Under various assumptions concerning the surface humidity, computed surface pressure decreased at a rate of twenty-five to thirty millibars per degree Celsius of increase in surface temperature. This is a substantially greater rate than that determined by Miller (1958) but is in agreement with Riehl's (1963) computations of hydrostatic pressure in hurricanes as a function of equivalent potential temperature. Author (GRA)

N74-20208# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOME NEW PATHS OF THE DEVELOPMENT OF LONG-RANGE WEATHER FORECASTS
M. I. Yudin 15 Jan. 1974 8 p Transl. into ENGLISH from the monograph "Nauchno-Populyarnyi Gidrometeorologicheskii, Sbornik, Chelovek i Stikhiya" USSR, 1972 p 40-41
(AD-773495; FTD-HT-23-719-74) Avail: NTIS CSCL 04/2

The report discusses the problems encountered in setting up a model for accurate long range weather forecasting. GRA

N74-20209# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE ACTION OF CONVECTIVE CLOUDS BY POWDER-LIKE REAGENTS
I. I. Gaivoronskii, L. P. Zatseipina, B. I. Zimin, and Yu. A. Seregin 11 Dec. 1973 14 p refs Transl. into ENGLISH from Tr. v Vsesoyuznogo Meteorol. Sezda. Sekts. Aktivn. Vozdeistvii na Atm. Protsessy (USSR), v. 4, 1972 p 79-86
(FTD Proj. T74-01-20)
(AD-773506; FTD-MT-24-218-74) Avail: NTIS CSCL 04/2

Results of experiments of actions by a coarsely dispersed aerosol on convective clouds of large vertical extent are given. Results indicate the effectiveness of powder-like reagents on thunderclouds, even in the stage of their stormy development when the rate of growth of the cloud vertex reaches 10 m/s. Radar observations of results of the action also indicate the effectiveness of the powder-like reagents. GRA

N74-20210# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HAIL IN KOMSOMOLSK-ON-AMUR
V. I. Yunusova 14 Jan. 1974 6 p Transl. into ENGLISH from the book "Nauchno-Populyarnyi Gidrometeorologicheskii. Sbornik, Chelovek i Stikhniya" USSR, 1972 p 181
(AD-773501; FTD-HT-23-721-74) Avail: NTIS CSCL 04/2

An account is given of a hailstorm in the region of Komsomolsk-on-Amur on July 23, 1970. GRA

N74-20211# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STATISTICAL METHODS IN THE OBJECTIVE ANALYSIS OF METEOROLOGICAL FIELDS
N. K. Grib and I. I. Polyak 17 Dec. 1973 17 p refs Transl. into ENGLISH from Tr. Glav. Geofiz. Obs. (Leningrad), no. 272, 1972 p 94-101
(AD-773510; FTD-HT-23-336-74) Avail: NTIS CSCL 04/2

The main purpose of the work is to describe a general mathematical-statistical approach to the problem of interpolating meteorological fields. GRA

N74-20212# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROTECTION AGAINST HAILSTORMS IN MOLDAVIA
L. A. Dinevich 15 Jan. 1974 11 p Transl. into ENGLISH from the publ. "Nauchno-Populyarnyi Gidrometeorologicheskii. Sbornik, Chelovek i Stikhiya" Romania, 1972 p 174-175
(AD-773523; FTD-HT-23-720-74) Avail: NTIS CSCL 04/2

The report discusses the methods and effectiveness of cloud seeding used in protecting crops from hailstorms. GRA

N74-20213# Wyoming Univ., Laramie. Agricultural Experiment Station.
ANALYSIS OF THE EFFECTS OF PRECIPITATION AUGMENTATION IN THE GREAT PLAINS AREA OF WYOMING Final Report, 15 Mar. 1971 - 30 Jun. 1973
30 Jun. 1973 313 p refs
(Contract DI-14-06-D-7156)
(PB-226046/1GA) Avail: NTIS HC $17.75 CSCL 04B

Work performed to study the potential effects of precipitation management on agricultural production and hydrology in eastern Wyoming is reported. Results for small grains indicate that the influence of added rainfall on agricultural production is largely dependent upon the time at which the rainfall occurs, ranging from optimum influence from mid-May through early June to negligible or negative influence early and late in the growing season. The estimated economic returns have been determined for winter wheat and are presented on a probability basis for each of 12 hypothetical precipitation change models. The increase in non-usable water due to seeding when compared with the amount of total water received as a result of natural rainfall and the increase due to seeding has been shown to be small. GRA

N74-20214# Wyoming Univ., Laramie. Water Resources Research Inst.
PSYCHROMETRIC DATA PATTERNS AND PREDICTION MODELS
Larry O. Pochop, Scott A. Morton, and Richard L. Cornia Oct. 1973 28 p refs
(Contract DI-14-31-0001-3851)
(PB-226116/2GA; Ser-38; W74-02220;
OWRR-A-008-WYO(1)) Avail: NTIS HC $3.00 CSCL 04B

Good psychrometric data are among the most difficult of all climatic parameters to obtain. However, uses of psychrometric data are numerous, especially in the field of water management. Temporal and spatial patterns of the psychrometric data in Wyoming are presented. Models for predicting psychrometric data from dry-bulb temperature are included. Author (GRA)

N74-20215# Naval Weather Service Command, Washington, D.C.
SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS: WESTERN EUROPEAN COASTAL MARINE AREAS. VOLUME 2: AREA 7, NANTES; AREA 8, PLYMOUTH; AREA 9, ENGLISH CHANNEL; AREA 10, DOVER STRAIT, AREA 11, BRISTOL CHANNEL
Jan. 1974 413 p
(AD-773594) Avail: NTIS CSCL 04/2

The data contained in these tables were obtained from tape data family 11 (TDF-11) marine surface observations. TDF-11 was primarily funded by the Naval Weather Service Command and selected by NWSED Asheville as the most comprehensive collection of marine surface observations from which to develop a series of coastal marine summaries. GRA

N74-20216# Calspan Corp., Buffalo, N.Y.
A PRELIMINARY INVESTIGATION OF THE INTERACTION BETWEEN PHOTOCHEMICAL AEROSOLS AND FOG Final Report, Apr. - Aug. 1973
Ulrich Katz and Warren C. Kocmond Jan. 1974 47 p refs
(Contract N00014-71-C-0291)
(AD-773642; CALSPAN-VC-3080-m-2) Avail: NTIS CSCL 04/2

Preliminary experiments were performed in an environmental smog chamber to study the influence of relative humidity and the presence of certain aerosols on the formation of photochemical aerosols and cloud condensation nuclei. The specific gaseous reactants chosen for this study were SO2 and the combination of propylene and NO2. The photooxidation of some key pollutants and the accompanying aerosol formation was observed under different humidity regimes. The subsequent interaction of the moisture with the photochemical aerosol under fog forming conditions was investigated. GRA

N74-20217# Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
A TRACER STUDY OF METEOROLOGICAL INFLUENCE ON THE DISPERSION OF GROUND-APPLIED INSECTICIDE AEROSOLS Final Report
John F. Schatmeyer and Paul Urone Aug. 1973 285 p refs (Contract DADA17-72-C-2098)
(AD-773653; APL-101) Avail: NTIS CSCL 04/2

Dispersion of insecticide aerosols was studied at a residential test site under a variety of nocturnal conditions. Five programmed sequential aerosol samplers were used to capture fluorescent particle traced aerosol droplets. Measurements were conducted at ground and elevated locations. Simultaneous and coincident biological measurements were performed with live caged mosquitos in order to assess standard rate ULV (ultra-low volume) applications of malathion insecticide. Meteorological measurements included vertical temperature and wind structures, atmospheric turbulence, net radiation, and reference wet and dry bulb temperatures. (Modified author abstract) GRA

N74-20218# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NUMERICAL METHODS OF SOLVING WEATHER FORECASTING PROBLEMS
G. I. Marchuk 28 Dec. 1973 17 p refs Transl. into ENGLISH from the publ. "Problemy Prikladnoi Matemathiki i Mekhaniki. Sbornik Statei" USSR, 1971 p 156-162
(AD-773897; FTD-HT-23-417-74) Avail: NTIS CSCL 04/2

The article discusses new algorithms for solving weather forecasting problems. GRA

N74-20219# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EFFECT OF ELECTRICAL FORCES ON THE DEVELOPMENT OF CLOUDS
I. M. Imyanitov, E. V. Chubarina, and Ya. M. Shvartz 14 Jan. 1974 22 p refs Transl. into ENGLISH from Tr. v Vsesoyuznogo Meteorol. Sezda. Sekts. Aktivn. Vozdeistvii na Atm. Protsessy (Leningrad), v. 4, 1972 p 193-203
(FTD Proj. T74-01-20)
(AD-773884; FTD-MT-24-228-74) Avail: NTIS CSCL 04/2

Studies of the electricity of clouds is of essential significance for cloud physics as a whole and for development of methods for influencing clouds, and especially intervention in thunderstorm processes within them - i.e., the question of the influence of the electrical properties of clouds on their development. GRA

N74-20220# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXPERIMENTAL AND THEORETICAL INVESTIGATIONS OF ARTIFICIAL CRYSTALLIZATION AND DISPERSAL OF SUPERCOOLED CLOUDS
I. I. Gaivoronskii, S. N. Dubinchuk, L. I. Krasnovskaya, A. V. Levin, V. N. Podgurskaya, I. P. Polovina, and A. V. Tkachenko 17 Dec. 1973 18 p refs Transl. into ENGLISH from Tr. v Vsesoyuznogo Meteorol. Sezda, Sekts. Aktivn. Vozdeistvil na Atm. Protsessy (Leningrad), v. 4, 1972 p 164-172
(AD-773294; FTD-MT-24-225-74) Avail: NTIS CSCL 04/2

Studied during experiments were features of the propagation of artificial crystallization in supercooled stratified clouds depending on the parameters of the clouds, conditions of their formation, the procedure for introduction of the reagent, and the norm of the seeding. Besides the number of parameters of the clouds and the state of the atmosphere, the width of the zone of crystallization at point in time after seeding was measured. Experiments on the study of microphysical processes and temperature conditions in the zone of crystallization were conducted. GRA

N74-20221# Hawaii Univ., Honolulu. Dept. of Information and Computer Science.
FORECASTING THE CONDITIONAL PROBABILITY OF FROZEN PRECIPITATION Interim Technical Report
Harry R. Glahn (Natl. Weather Service, Silver Spring, Md.), Joseph R. Bocchiere (Natl. Weather Service, Silver Spring, Md.), and Richard H. Jones 1973 11 p refs
(Grant AF-AFOSR-2405-72; AF Proj. 9769)
(AD-773365; AFOSR-74-0037TR) Avail: NTIS CSCL 04/2

Equations for forecasting the conditional probability of frozen precipitation have been developed for 186 stations using a logistic function model. The independent variables are three variables predicted by the National Meteorological Center's Primitive Equation model, 1000-500 mb thickness boundary layer temperature, and 850 mb temperature. The forecasts have been made operational by the National Weather Service.
Author (GRA)

N74-20222# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RESEARCH ON CONDITIONS WHICH DETERMINE THE PASSIVATING ACTION OF SURFACE-ACTIVE SUBSTANCES ON HYGROSCOPIC CONDENSATION NUCLEI
R. A. Bakhanova, B. V. Deryagin, Yu. S. Kurgin, L. F. Leonov, and P. S. Prokhorov 7 Jan. 1974 30 p refs Transl. into ENGLISH from Tr. Vses. Meteorol. Sezda, Sekts. Aktivn. Vozdeistvii Atmosfernye Protsessy (USSR), v. 4, 1972 p 146-163
(AD-773293; FTD-MT-24-224-74) Avail: NTIS CSCL 04/1

Contents: theoretical bases of passivation of condensation nuclei; experiments on the passivation of hygroscopic nuclei; experiments on the passivation of hygroscopic nuclei in an aerosol chamber under conditions of variable humidity; study of the passivation of hygroscopic condensation nuclei by jet method. GRA

N74-20223# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STABILITY OF AN IMPLICIT NUMERICAL SCHEME
Z. I. Tsvitinidze 17 Dec. 1973 11 p refs Transl. into ENGLISH from Tr. Gidrometeor. Nauchno-Issled. Tsentr SSSR (USSR), no. 99, 1972 p 31-35
(AD-773285; FTD-HT-23-568-74) Avail: NTIS CSCL 04/2

To develop numerical methods for weather forecasting, the author discusses the problem of choosing algorithms, which are stable with respect to non-linear effects and have a high approximation accuracy. GRA

N74-20224# Fresno State Coll. Foundation, Calif.
ATMOSPHERIC WATER RESOURCES RESEARCH. VOLUME 1: SUMMARY OF ACCOMPLISHMENTS Final Report, 1 Jul. 1968 - 31 Aug. 1973
31 Aug. 1973 128 p refs
(Contract DI-14-06-D-6592)
(PB-225847/3GA) Avail: NTIS HC $8.50 HC also available from NTIS $58.00/set of 6 reports as PB-225846-SET CSCL 04B

The accomplishments and research conducted by Atmospheric Water Resources Research, California State University, Fresno Foundation, in the CENSARE (CENtral SierrA REsearch) project under the U.S. Bureau of Reclamation's 'Sky Water' program are presented. The CENSARE project comprised a wintertime cloud seeding and storm observation research effort in the central Sierra Nevada range in California for the years 1968 through 1973. The CENSARE program was a comprehensive weather modification project including cloud seeding operations by aircraft and ground units, extensive surface and upper-air observations, and detailed analyses and evaluations of results. The final analyses and evaluations showed precipitation enhancement of 5 to 10 percent occurred as a result of cloud seeding. A pilot study of possible summertime cumulus seeding potential over the CENSARE target area was conducted. Results indicated increases of 100 percent of more could be realized on an average of 20 summer days. (Modified author abstract) GRA

N74-20225# Fresno State Coll. Foundation, Calif.
ATMOSPHERIC WATER RESOURCES RESEARCH. VOLUME 2: CENSARE CLOUD SEEDING OPERATIONS MANUAL Final Report, 1969 - 1972
G. L. Smith, D. A. Griffith, J. R. Vowell, and W. F. Rowland 31 Aug. 1973 93 p refs 6 Vol.
(Contract DI-14-06-D-6592)
(PB-225848/1GA) Avail: NTIS HC $6.75; Paper copy also available from NTIS $58.00/set of 6 reports as PB-225846-SET CSCL 04B

The procedures are discussed which were used in conducting cloud seeding operations for winter orographic precipitation augmentation purposes on the CENSARE project. The criteria

and techniques for targeting the effect, optimal conditions for seeding, recommended revisions in seeding systems and operations, and further research needs are included. The seeding was conducted on an experimental basis in the upper portions of the Mokelumne and Stanislaus river basins in the central Sierra Nevada of California during 1969 to 1972. GRA

N74-20226# Fresno State Coll. Foundation, Calif.
ATMOSPHERIC WATER RESOURCES RESEARCH. VOLUME 3: CLIMATOLOGICAL ASSESSMENT OF WINTER PRECIPITATION OVER THE SIERRA NEVADA Final Report, 1969 - 1972
D. L. Bailey 31 Aug. 1973 192 p refs 6 Vol.
(Contract DI-14-06-D-6592)
(PB-225849/9GA) Avail: NTIS HC $11.75; Paper copy also available from NTIS $58.00/set of 6 reports as PB-225846-SET CSCL 04B

Contents: application of the Rocky Mountain climatological winter precipitation model to the Sierra Nevada; analysis of winter precipitation over the Sierra by process, rate, duration, and location; analysis of precipitation rate by storm type. GRA

N74-20227# Fresno State Coll. Foundation, Calif.
ATMOSPHERIC WATER RESOURCES RESEARCH. VOLUME 4: EMPIRICAL ASSESSMENT OF ACCRETION MICROPHYSICS Final Report, 1969 - 1972
R. F. Reinking 31 Aug. 1973 332 p refs
(Contract DI-14-06-D-6592)
(PB-225850/7GA) Avail: NTIS HC $18.75 CSCL 04B

The main result of this investigation is a more realistic microphysical description of accretion in general and as it occurs specifically in Sierra snowstorms. The theory of accretion was critically analyzed and expanded. The various effects of crystal cross-sectional areas, crystal and droplet terminal velocities, and crystal collection efficiencies were evaluated. Effects of the quantity and spatial uniformity of cloud liquid water on the accretion rate were examined. Precipitation-forming mechanisms that are active simultaneously with the growth of regular crystals by diffusion and accretion were studied. Crystal multiplication processes were found to play a significant role in the Sierra snowstorms. Droplet collisioncoalescence was shown to occur but to produce little precipitation at the elevations that realize the greatest precipitation amounts.
(Modified author abstract) GRA

N74-20228# Fresno State Coll. Foundation, Calif.
ATMOSPHERIC WATER RESOURCES RESEARCH. VOLUME 5: SUNDRY ANALYSES AND EVALUATIONS Final Report, 1969 - 1972
D. A. Griffith, J. Smith, R. Peace, and D. Lehrman 31 Aug. 1973 143 p refs
(Contract DI-14-06-D-6592)
(PB-225851/5GA) Avail: NTIS HC $9.25 HC also available from NTIS $58.00/set of 6 reports as PB-225846-SET CSCL 04B

During the final months of the CENSARE Project several evaluations or investigations were completed. Some of these were extensions on previous approaches, others are independent investigations designed to assess the overall effect of the seeding operations. Section 2 reports on the feasibility of summertime cloud modification in the CENSARE target area. Section 3 extends previous statistical treatment of storm precipitation amounts to determine if cloud seeding was effective in the CENSARE target area. Section 4 presents a large-scale precipitation analysis. The area covered included most of the Northern and Central Sierra and Nevada for the years of 1932 to 1973. Section 5 extends the AWRR storm typing to the CENSARE target area and Feather River region for the winter seasons of 1929 to 1953. GRA

N74-20229# Fresno State Coll. Foundation, Calif.
ATMOSPHERIC WATER RESOURCES RESEARCH. VOLUME 6: DATA REDUCTION AND ARCHIVING Final Report, 1969 - 1972
31 Aug. 1973 150 p refs
(Contract DI-14-06-D-6592)
(PB-225852/3GA) Avail: NTIS HC $9.50 HC also available from NTIS $58.00/set of 6 reports as PB-225846-SET CSCL 04B

Contents: precipitation; upper air observations; stream flow; miscellaneous data collection; snow crystals; cloud seeding generator operations; appendices. GRA

N74-20039 Direction des Recherches et Moyens d'Essais, Paris (France). Section d'Etudes et Fabrication de Telecommunications.
MEASUREMENT OF METEOROLOGICAL DATA [MESURE DES DONNEES METEOROLOGIQUES]
I. A. Franc *In* Inst. Franco-Allemand de Rech. Meas. Methods in Ballistics 1973 p 199-207 In FRENCH (For availability see N74-20028 11-14)

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N74-20230*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MARINER MARS 1971 INERTIAL REFERENCE UNIT
G. T. Starks 1 Mar. 1974 20 p
(Contract NAS7-100)
(NASA-CR-137356; JPL-TM-33-662) Avail: NTIS HC $4.00 CSCL 17G

The design concept of an inertial reference unit is reported that uses the gyroscope in a rate mode in conjunction with a unique application of a drift compensated and temperature stabilized solid state integrator for the inertial mode. A typical test program and results for an inertial reference unit as applied to the Mariner Mars 1971 program to achieve highly reliable spacecraft operation are also described. Author

N74-20231# National Aerospace Lab., Tokyo (Japan).
THEORETICAL ANALYSIS OF A PASSIVE MAGNETIC SUSPENSION SYSTEM WITH AN EIGHT POLE STATOR FOR FLOATED INERTIAL SENSORS
Minoru Takizawa, Masao Tsuki, and Takao Suzuki Sep. 1973 13 p refs In JAPANESE; ENGLISH summary
(NAL-TR-338) Avail: NTIS HC $4.00

High precision inertial sensors such as gyros and accelerometers are discussed which are necessary to launch a space vehicle successfully. In order to develop more precise sensors, the axes of the sensors are provided with suspension systems which are free from uncertain torque about the axes. A magnetic suspension system is one of the systems which have this capability. A passive magnetic suspension system with an eight-pole stator is theoretically analyzed, which can be applied to supporting the output axes of the sensors. In this theoretical analysis, the analytical imperfections are taken into consideration, and the equation of the magnetic suspension force is directly derived from an equation of the magnetic energy which exists in the gaps. Static characteristics of the magnetic suspension systems which are obtained by means of digital computation are discussed. Consequently it is proved that the equation is applicable to the unstable region of the magnetic suspension force. Then, it is shown that the analytical results, with relation to the magnetic suspension force, are in close accordance with Frazier's results, within a small displacement of the output axis. Author

N74-20232# TRW Systems Group, Redondo Beach, Calif.
NUCLEAR INSTRUMENT LANDING SYSTEM Phase 2 Interim Report, Jun. 1971 - Jan. 1973
R. A. Kaminskas 31 Jan. 1973 88 p Sponsored in part by FAA
(Contract AT(04-3)-828)
(SAN-828-2) Avail: NTIS HC $5.45

The analysis, design, construction, and field tests of a prototype Nuclear Instrument Landing System (NILS) are reported. NILS is designed as a short range guidance system for providing highly accurate aircraft position information during the last phases of descent and touchdown for completely automated landings in zero visibility weather. The NILS consists of ground and airborne equipment: the ground equipment is comprised of four beacons

of modulated gamma beams and is permanently installed near the runway; the airborne equipment consists of a scintillation detector, four frequency detectors, and signal processing electronics. NSA

N74-20233# Raytheon Co., Wayland, Mass.
MICROWAVE LANDING SYSTEM (MLS) DEVELOPMENT PLAN AS PROPOSED BY RAYTHEON DURING THE TECHNIQUE ANALYSIS AND CONTRACT DEFINITION PHASE OF THE NATIONAL MLS DEVELOPMENT PROGRAM. VOLUME 3: 1.1.1 PERFORMANCE VALIDATION
Sep. 1972 366 p refs
(Contract DOT-FA72WA-2803)
(AD-773223; FAA-RD-73-150-Vol-3) Avail: NTIS CSCL 17/7

Volume III discusses multipath, power/error budgets, hardware realization, and system integrity. GRA

N74-20234# Hazeltine Corp., Greenlawn, N.Y.
POSITION LOCATION ANALYSIS Final Report, 1 Jul. 1972 - 15 Jan. 1973
P. Sakson, B. Grossman, and J. Breda Sep. 1973 123 p
(Contract F30602-72-C-0477)
(AD-773849; RADC-TR-73-293; Rept-6174) Avail: NTIS CSCL 17/7

The program provided for the development of a real time data processing and display system for the Air Force's Low Cost Traffic Control (LCTC) experiment. The LCTC experiment will test the applicability of low-power, spread spectrum aircraft transmissions to provide the basis for a low-cost, real time, precision, aircraft surveillance and collision avoidance system. The real time data processing and display system developed makes use of a PDP11 minicomputer and a CRT display. These equipments have been programmed to accept input data from two aircraft; the input data takes the form of a set of four binary coded decimal numbers read from four time interval counters, plus standard range time (from a digital clock). Typically, a new field of numbers arrives several times a second. The PDP11 processes this input data in real time and generates a plan position display of the aircraft tracks and their projected positions. The display also presents tabular information such as aircraft heading, velocity and altitude, along with time and collision information. (Modified author abstract) GRA

N74-20235# Army Electronics Command, Fort Monmouth, N.J.
PREDICTIONS OF INTERFERENCE-REFLECTION ZONES FOR SCANNING BEAM INSTRUMENT LANDING SYSTEMS
Eddie L. Cornelious Jan. 1974 55 p refs
(DA Proj. 1F1-62202-A-97A)
(AD-773822; ECOM-4188) Avail: NTIS CSCL 17/7

To predict reflection/interference zones for scanning beam Instrument Landing Systems, representative situations for an airport environment were selected in developing multipath models. Interfering signals reflected from a large building near a runway will usually be confined to well defined specular regions. The interfering reflecting signal magnitude in these regions can be large. The report presents these regions of interfering reflections in graphic form for various reflecting surface orientations and lateral distances between the radiating source and the reflecting surface. Author (GRA)

N74-20236# Aerospace Corp., El Segundo, Calif. Technology Div.
HIGH ALTITUDE NAVIGATION STUDY (HANS) Report for Jan. - Jun. 1973
J. L. LeMay, W. L. Brogan, and C. E. Seal 29 Jun. 1973 152 p refs
(Contract F04701-72-C-0073)
(AD-773835; TR-0073(3491)-1; SAMSO-TR-74-10) Avail: NTIS CSCL 17/7

A study was made of various navigation configurations for use in satellites in earth orbit at high altitudes (apogee/perigee average values greater than 5,000 nmi). A large number of orbit/configuration combinations were examined of which a total of 54 were deemed sufficiently attractive for in-depth investigation. The study goals were primarily to determine convergence times and steady-state performances of attractive navigation configurations for use in various Air Force missions projected to the 1985 time period. The technique used was that of computer simulation of recursive filter techniques combined with appropriate analyses as required. Extensive results were obtained and presented in various statistical forms to lend credibility to their values. (Modified author abstract) GRA

N74-20237# Lincoln Lab., Mass. Inst. of Tech., Lexington.
PREDICTION OF OPTICAL LANDING GUIDANCE SYSTEM PERFORMANCE IN CAT. 3-a MINIMUM WEATHER
David G. Kocher 8 Nov. 1973 38 p refs
(Contract F19628-73-C-0002; AF Proj. 649L)
(AD-773830; TN-1973-47; ESD-TR-73-258) Avail: NTIS CSCL 17/7

The feasibility of using a laser optical system to provide precision guidance for the final two miles of aircraft landing approaches in low visibility weather is examined. Since low visibility is caused most frequently by clouds and fog, approximate calculations of the optical signal, scattered light and noise are made as a function of range for various cloud and fog densities. It is concluded that with current laser technology, performance of an optical landing guidance system would be inadequate in the presence of Category III-a minimum visibility clouds and fogs. Author (GRA)

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N74-20238*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DEVELOPMENT CONCEPT FOR A SMALL, SPLIT-CORE, HEAT-PIPE-COOLED NUCLEAR REACTOR
Edward Lantz, Roland Breitwieser, and George F. Niederauer Washington Apr. 1974 35 p refs
(NASA-TM-X-2996; E-7542) Avail: NTIS HC $3.25 CSCL 18K

There have been two main deterrents to the development of semiportable nuclear reactors. One is the high development costs; the other is the inability to satisfy with assurance the questions of operational safety. This report shows how a split-core, heat-pipe cooled reactor could conceptually eliminate these deterrents, and examines and summarizes recent work on split-core, heat-pipe reactors. A concept for a small reactor that could be developed at a comparatively low cost is presented. The concept would extend the technology of subcritical radioisotope thermoelectric generators using 238 PuO2 to the evolution of critical space power reactors using 239 PuO2. Author

N74-20239# Los Alamos Scientific Lab., N.Mex.
LASL ROVER PROGRAM Quarterly Progress Report, period ending 31 Aug. 1972
F. Skoberne, Comp. Sep. 1972 53 p refs
(Contract W-7405-eng-36)
(LA-5054) Avail: NTIS HC $4.75

Progress made in the Rover Program at the Los Alamos Scientific Laboratory is reported for the quarter ending August 31, 1972. Major efforts were the publication of a Preliminary Report for the Nuclear Engine Definition Study; Nuclear Furnace design and development, including the successful testing of Nuclear Furnace-1; further development of carbide-graphite composite materials; and carbide fuel and carbide component research. Other areas reported include NRDS activities, nondestructive testing, properties-of-materials research, and irradiation tests. Author (NSA)

N74-20240*# General Dynamics/Fort Worth, Tex. Convair Aerospace Div.
NERVA IRRADIATION PROGRAM. GTR 23, VOLUME 1: COMBINED EFFECTS OF REACTOR RADIATION AND CRYOGENIC TEMPERATURE ON NERVA STRUCTURAL

MATERIALS
R. H. McDaniel, E. W. Bradford, J. H. Lewis, and J. B. Wattier Jan. 1973 165 p refs
(Contracts SNPC-73; AF 29(601)-7077)
(NASA-CR-137267; FZK-394-1) Avail: NTIS HC $10.25 CSCL 18I

Specimens fabricated from structural materials that were candidates for certain NERVA applications were irradiated in liquid nitrogen (LN2), liquid hydrogen (LH2), water, and air. The specimens irradiated in LN2 were stored in LN2 and finally tested in LN2, or at some higher temperature in a few instances. The specimens irradiated in LH2 underwent an unplanned warmup while in storage so this portion of the test was lost; some specimens were tested in LN2 but none were tested in LH2. The Ground Test Reactor was the radiation source. The test specimens consisted mainly of tensile and fracture toughness specimens of several different materials, but other types of specimens such as tear, flexure, springs, and lubricant were also irradiated. Materials tested include Hastelloy X, Al, Ni steel, steel, Be, ZrC, Ti-6Al-4V, CuB, and Ti-5Al-2.5Sn. Author (NSA)

N74-20241# Bureau International des Poids et Mesures, Sevres (France).
TIME INTERVALS BETWEEN CORRELATED PULSES
J. W. Mueller 1972 5 p In FRENCH
(BIPM-72-3) Avail: AEC Depository Libraries HC $3.00

If the lifetime of the intermediate state is negligible for the detector employed, the two pulses resulting from a nuclear cascade decay arrive simultaneously. They can be recorded and separated using a coincidence circuit. If the time duration is similar to the resolving time or exceeds this time, the time ratios existing between the different radiations are used: e.g., the coefficient of correlation is measured for the process under consideration as a function of a variable delay. The time interval distribution between successive pulses is modified as a function of the mean life of the intermediate state. The empirical density of the successive intervals in a parent-daughter process is calculated using a Monte Carlo type simulation. NSA

N74-20242# California Univ., Livermore. Lawrence Livermore Lab.
GEOMETRY AND HETEROGENEOUS EFFECTS ON THE NEUTRONIC PERFORMANCE OF A YIN YANG MIRROR REACTOR BLANKET
J. D. Lee 17 Oct. 1973 12 p refs Presented at the 5th Symp. on Eng. Probl. of Fusion Res., Princeton, N. J., 6 Nov. 1973
(UCRL-75141; Conf-731114-5) Avail: NTIS HC $3.00

Two-dimensional models and Monte Carlo neutron transport techniques were used to calculate the tritium breeding and energy generation in a mirror-reactor blanket. Results indicate that blanket performance should be quite insensitive to variations in overall geometry as long as there are no large neutron-leakage paths. Injection and leakage penetration can be accommodated as long as the first-wall penetration area subtends lass than 25% of the first wall's spherical area. Heterogeneous and streaming effects in a tubular blanket can be important, but are negligible for closely packed arrays of tubes. The one-dimensional homogeneous spherical-shell model appears to be a useful tool for predicting performance of a tubular blanket conforming to the Yin Yang mirror geometry. Author (NSA)

N74-20243# Commission of the European Communities, Brussels (Belgium). Central Bureau for Nuclear Measurements.
RECOMMENDATION ON THE MEASUREMENT OF RADIATION-INDUCED DAMAGES IN REACTOR STRUCTURAL MATERIAL
Oct. 1973 10 p In FRENCH
(EUR-5035) Avail: AEC Depository Libraries HC $3.00

Recommendations are presented for irradiation measurements on metals and expecially that of steel. This publication follows the report EUR-4867f, already published, which treated essentially graphite irradiations. Author (NSA)

N74-20244# Commission of the European Communities, Karlsruhe (West Germany). Inst. for Transuranium Elements.
SOME PHASE EQUILIBRIUM AND THERMODYNAMIC CONSIDERATIONS FOR IRRADIATED OXIDE NUCLEAR FUELS. PART 1: THE PHASE EQUILIBRIA AND THERMODYNAMICS OF THE URANIUM-PLUTONIUM-OXYGEN SYSTEMS. PART 2: FISSION PRODUCT PHASE DIAGRAMS
P. E. Potter Jun. 1973 63 p refs Presented at IAEA Panel Meeting on the Behavior and Chem. State of Fission Products in Irradiated Fuels, Vienna, 6-11 Aug. 1972
(EUR-5013; Conf-720862-1) Avail: AEC Depository Libraries HC $5.25, EUR B.Fr. 70.

The recent published data on the phase equilibria and thermodynamics of the appropriate oxide systems are considered. The binary systems, uranium-oxygen and plutonium-oxygen are considered along with the ternary system uranium-plutonium-oxygen and the systems of the major fission products with uranium-oxygen and plutonium-oxygen. NSA

N74-20245# Atomics International, Canoga Park, Calif.
SNAP 8 Summary Report
24 Sep. 1973 194 p refs
(Contract AT(04-3)-701)
(AI-AEC-13070) Avail: NTIS HC $11.75

The SNAP 8 Program was directed toward the development of lightweight nuclear reactors which would operate in space for greater than 10,000 hr at a power level of 600 kW(t). Toward this objective, two reactors were designed, built and successfully operated. The experimental reactor (S8ER) was an engineering test of a prototype core, but did not have flight-developed hardware. The development reactor (S8DR) was a nuclear system test to verify the operability of the integrated flight configuration. The development, design characteristics, operating experience, experimental results, and supporting tests for the S8ER and S8DR are discussed. Author (NSA)

N74-20246# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Technische Physik.
IRRADIATION EXPERIMENTS WITH THERMIONIC FUELS IN THE KERNFORSCHUNGSANLAGE JUELICH
J. Herion Jun. 1973 48 p refs In GERMAN
(JUL-960-TP) Avail: AEC Depository Libraries HC $4.50

Within the framework of the ITR project, two irradiation experiments have been carried out with thermionic fuel elements (triple diodes). Irradiation times of 1,545 and 1,466 hours were obtained with an average capacity of 32 W/sq cm of emitting surface. Following a brief description of the experimental equipment, the essential parameters and the current-voltage curve in the second experiment are presented. The experiments had to be interrupted for safety reasons as leaks occurred in the fission gas chambers. NSA

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics, 20 Meteorology; and 29 Space Radiation.

N74-20247 New York Univ., N.Y.
THE PROPAGATION OF ULTRASHORT LIGHT PULSES IN RESONANT MEDIA Ph.D. Thesis
Thomas Wood Barnard 1973 115 p
Avail: Univ. Microfilms Order No. 74-1842

The propagation of ultrashort coherent light pulses in resonant media is analyzed in the semi-classical approximation by treating the field classically and the resonant, two level medium quantum mechanically. All homogeneous relaxation times are neglected; however, inhomogeneous broadening is included by averaging over the energy separation distribution function. The resulting set of coupled, nonlinear equations of motion are solved for both steady state and nonsteady state pulses. The steady state solutions include the 2 pi hyperbolic secant pulse characteristic of self induced transparency and pulse trains described by the Jacobi elliptic functions. These solutions hold for both inhomogeneously broadened and unbroadened media. From the set of twelve Jacobi elliptic functions which satisfy the equations of motion, only four are found to be physically acceptable and they can be reduced to a single form by suitable transformations

of the independent variable and the eliptic function modulus.
Dissert. Abstr.

N74-20248 Case Western Reserve Univ., Cleveland, Ohio.
ELECTRICALLY AND OPTO-ELECTRICALLY INDUCED THERMAL REFRACTIVE INDEX CHANGES IN CADMIUM SULPHIDE Ph.D. Thesis
James Robert Onstott 1973 98 p
Avail: Univ. Microfilms Order No. 74-2555

Methods of generating and observing refractive index changes in Cadmium Sulphide are discussed. The refractive index changes observed are generally explainable by simple thermal heating arguments. Photoconductive interactions were generated with the 5145 A line from an Argon laser. The magnitude of the observed index changes varied from 10 to the minus 2 power to 10 to the minus 8 power. All index changes were positive which is consistent with the thermal explanation. Time constants of the observed changes varied from 0.5 seconds of 4 seconds. All index changes were measured with a Michelson interferometer illuminated by Helium-Neon lasers operating on either the 6328 A or 1.15 micron transitions. Large index changes were measured by counting fringe shifts. Smaller changes were observed using a stabilized interferometer to measure time varying changes induced by modulated 5145 A light Modulation frequencies varied between 20 Hz and 50 KHz. Dissert. Abstr.

N74-20249# Aerospace Corp., El Segundo, Calif.
TEMPORAL-FREQUENCY SPECTRUM OF AN OPTICAL WAVE PROPAGATING IN A TURBULENT MEDIUM UNDER STRONG SCINTILLATION CONDITIONS
H. T. Yura 29 Mar. 1974 16 p refs
(ATR-74(8171)-1) Avail: NTIS HC $4.00 CSCL 20F

An expression is derived for the log amplitude frequency spectrum of a plane wave propagating in a turbulent medium, which is valid under strong scintillation conditions. Here the Kolmogorov spectrum is considered and the following results were obtained: for (sigma sub T) sq is less than or approximately equal 1, the results of the analysis agree with other authors. For (sigma sub T)sq is greater than or approximately equal 1, the frequency spectrum shifts to higher frequencies; the peak in the spectrum being obtained for V sub peak equals (v sub 0) ((sigma sub T) to the 6/5)power, where v is the peak frequency obtained for (sigma sub T)sq is less than or approximately equal 1. In addition, the spectrum both broadens and the maximum value of the spectrum decreases with increasing values of (sigma sub T)sq. It is demonstrated that the normalized log amplitude temporal frequency spectrum is a universal function of v/v sub 0 only for (sigma sub T)sq is less than or approximately equal 1. Finally, some implications regarding experimental measurements of the log amplitude variance in the saturation regime are discussed. Author

N74-20250# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards
PRECISION MEASUREMENT AND CALIBRATION. VOLUME 10: IMAGE OPTICS Final Report
Calvin S. McCamy, ed. Nov. 1973 953 p refs
(NBS-SP-300-Vol-10; LC-68-60042) Avail: SOD HC $11.10 as C13.10:300/V.10

A bibliography is presented of articles concerning image optics, including photography. The articles are grouped in the following areas: (1) refractometry and optical homogeneity, (2) interferometry in image optics, (3) optical design and image evaluation, and (4) photographic science. For individual titles, see N74-20251 through N74-20312.

N74-20251 National Bureau of Standards, Washington, D.C.
STANDARD CONDITIONS FOR PRECISE PRISM REFRACTOMETRY
Leroy W. Tilton *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 1-36 refs Repr. from J. Res. Natl. Bur. Stand., v. 14, Apr. 1935 p 393-418 (For availability see N74-20250 11-23)
(NBS-RP-776)

Air as a standard reference medium for precise refractive-index measurements is discussed with respect to the precision necessary in the control and measurement of its temperature, pressure, humidity, and carbon-dioxide content. Particular attention is given to the selection of provisional values for alpha, the optical temperature coefficient for air; and the preparation of accurate correction tables for the reduction of refractive-index observations to standard conditions of reference is described and exemplified. The approximate range of temperature effects on absolute refractive index is indicated; also the range of pressure effects on liquids. An empirical relation between index and density is derived from Pockels' optical data on elastically deformed glass and a basis for quantitative treatment of permissible stress-birefringence is given. Tolerance equations are given for all requirements that are quantitatively discussed and it is concluded that both precision and accuracy to within + or - 2 or 3 x 10 to the -6th power can be attained in determining refractive index by the classical method of minimum deviation.
Author

N74-20252 National Bureau of Standards, Washington, D.C.
A PRECISION APPARATUS FOR THE RAPID DETERMINATION OF INDICES OF REFRACTION AND DISPERSION BY IMMERSION
Conrad A. Faick and Bernard Fonoroff *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 27-36 refs Repr. from J. Res. Natl. Bur. Stand., v. 32, Feb. 1944 p 67-75 (For availability see N74-20250 11-23)
(NBS-RP-1575)

A new immersion method for determining indices of refraction and nu values, employing the double-diaphragm method for securing oblique illumination, is described. The average error in the determination of indices of refraction based upon 144 measurements is 0.00002; the maximum error is 0.00005. Complete measurements of the indices of refraction for the sodium D line and the hydrogen F and C lines may be made in approximately 1 and 1/2 hours, and from these measurements the nu values may be calculated with an average error of 0.1 and a maximum error of 0.8. Author

N74-20253 National Bureau of Standards, Washington, D.C.
REFRACTIVE INDEX OF POTASSIUM BROMIDE FOR INFRARED RADIANT ENERGY
Robert E. Stephens, Earle K. Plyler, William S. Rodney, and Robert J. Spindler *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 37-39 refs Repr. from J. Opt. Soc. Am., v. 43, no. 2, Feb. 1953 p 110-112 Presented at Opt. Soc. of Am., New York, 21 Mar. 1952 Sponsored in part by the AF and Army (For availability see N74-20250 11-23)

The index of refraction of potassium bromide at 22 C has been measured for the infrared region from 1 micron to 25 microns by means of two methods on two different instruments. The two resulting sets of indexes agree to within the probable error of either one except at the two longest wavelengths. A five constant expression has been found that represents the index as a function of wavelength over the region from 0.4047 microns to 25 microns. Indexes were measured at several of the wavelengths at temperatures higher and lower than 22 C and thermal coefficients of index were computed. Author

N74-20254 National Bureau of Standards, Washington, D.C.
RELATIVE STRESS-OPTICAL COEFFICIENTS OF SOME NATIONAL BUREAU OF STANDARDS OPTICAL GLASSES
Roy M. Waxler and Albert Napolitano *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 40-44 refs Repr. from J. Res. Natl. Bur. Stand., v. 59, no. 2, Aug. 1957 p 121-125 (For availability see N74-20250 11-23)
(Contract AF 18(600)-139)
(NBS-RP-2779)

The relative stress-optical coefficients of 27 optical glasses made at the National Bureau of Standards were determined. The glasses were loaded in compression, and the amount of birefringence was measured with a polarimeter, using a quarter-wave plate compensator. The stress-optical coefficients determined for the crown glasses ranged between +2.95 and +1.82 brewsters. For the flint glasses, a regular variation of the stress-optical coefficient with weight percent of lead oxide was found with values ranging from +3.18 to -1.16 brewsters.
Author

N74-20255 National Bureau of Standards, Washington, D.C.
RAPID METHOD FOR INTERPOLATING REFRACTIVE

INDEX MEASUREMENTS
Orestes N. Stavroudis and Loyd E. Sutton *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 45-46 refs Repr. from J. Opt. Soc. Am., v. 51, no. 3, Mar. 1961 p 368-370 (For availability see N74-20250 11-23)

A method is described for the application of a two-term Sellmeier equation to experimental data to obtain an interpolation formula for refractive index versus wavelength. F.O.S.

N74-20256 National Bureau of Standards, Washington, D.C.
FITTING REFRACTIVE INDEX DATA BY LEAST SQUARES
Loyd E. Sutton and Orestes N. Stavroudis *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 47-51 refs Repr. from J. Opt. Soc. Am., v. 51, no. 8, Aug. 1961 p 901-905 (For availability see N74-20250 11-23)

The accessibility of high-speed computing machinery makes practicable the use of a routine for the least-squares fitting of a three-term Sellmeier equation to a set of experimentally determined values of index of refraction. The constants of a two-term Sellmeier equation are evaluated by a method described previously. These are then used in a preliminary fitting of another term. The rough fit is then improved by an iterative process which includes an acceleration technique to speed convergence to the final result. In a typical example the average residual of index is only about 0.00002 for 46 wavelengths from 0.2652 microns to 10.346 microns. Author

N74-20257 National Bureau of Standards, Washington, D.C.
EFFECT OF PRESSURE AND TEMPERATURE ON THE REFRACTIVE INDICES OF BENZENE, CARBON TETRACHLORIDE, AND WATER
R. M. Waxler and C. E. Weir *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 52-60 refs Repr. from J. Res. Natl. Bur. Stand., A. Phys. Chem., v. 67A, no. 2, Mar.-Apr. 1963 p 163-171 (For availability see N74-20250 11-23)
(Paper-67A2-203)

An interferometer for measuring change in index of refraction with pressure is described. Absolute indices of refraction are reported to five decimals for benzene, carbon tetrachloride, and water at pressures as high as 1100 bars over a small temperature range. The results of replicate measurements agree to within + or - 0.0001. Various equations relating index and specific volume show systematic deviations in all cases. At constant specific volume, the index of carbon tetrachloride increases with increasing temperature, while the index of water decreases with increasing temperature. The refractive index of benzene shows no effect due solely to temperature within the experimental error. Possible explanations for this behavior are discussed. Author

N74-20258 National Bureau of Standards, Washington, D.C.
EFFECT OF HYDROSTATIC PRESSURE ON THE REFRACTIVE INDICES OF SOME SOLIDS
R. M. Waxler and C. E. Weir *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 61-69 refs Repr. from J. Res. Natl. Bur. Stand., A. Phys. Chem., v. 69A, no. 4, Jul.-Aug. 1965 p 325-333 (For availability see N74-20250 11-23)
(Paper-69A4-352)

Measurements were made on refractive index changes with hydrostatic pressures between 1 bar and 1 kbar using the helium yellow line. The materials studied were: KBr, NaCl, LiF, diamond, MgO, quartz, Al_2O_3, and three silicate glasses. All the materials increased in refractive index with pressure except diamond, MgO, and Al_2O_3 which decreased, and LiF which did not change. The results were compared with photoelastic measurements, and Pockel's geometric theory of photoelasticity was substantiated as well as Mueller's physical theory. The data show that the ratio of change of polarizability with density is greater for solids having stronger interatomic repulsive forces. Volume and temperature coefficients of polarizability were evaluated for the cubic crystals and glasses. The thermo-optic behavior of crystals and glasses is discussed. Author

N74-20259 National Bureau of Standards, Washington, D.C.
THE PERFORMANCE OF LENSES MADE FROM INHOMOGENEOUS GLASSES
Fred W. Rosberry *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 70-73 refs Repr. from Appl. Opt., v. 4, Jan. 1965 p 21-24 Supported by ARPA (For availability see N74-20250 11-23)

The performance of lenses made from glass elements containing defects such as bubbles, streaks, striae, etc. were measured and an attempt made to compare the effect of the various defects. Four defective lenses and a good or control lens were used. The performance in the image plane was determined by four different evaluation procedures. A summary evaluation showed that the lens containing striae, although the most difficult defect to detect, produced the lowest quality image. Author

N74-20260 National Bureau of Standards, Washington, D.C.
THE MEASUREMENT OF HOMOGENEITY OF OPTICAL MATERIALS IN THE VISIBLE AND NEAR INFRARED
F. W. Rosberry *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 74-79 refs Repr. from Appl. Opt., v. 5, Jun. 1966 p 961-966 Supported by ARPA (For availability see N74-20250 11-23)

A procedure is described for determining the inhomogeneities of a sample of optical material in terms of small changes in index of refraction at discrete points over the measured surface. The method is used in the visible-and near-IR regions of the spectrum. An He-Ne gas laser source was used for the IR measurements. The variation in index was mapped with contour lines enclosing areas of similar index variations. The largest index change in 1-cm distance was noted and recorded as the maximum variation per centimeter. Over twenty-five different samples of six different materials were examined. The results are presented in a chart indicating the range of maximum refractive index variations of the samples observed. Data are shown to illustrate the possibility of determining index values to higher precision than the material justifies. Author

N74-20261 National Bureau of Standards, Washington, D.C.
A SPECIAL METHOD FOR PRECISE REFRACTIVE INDEX MEASUREMENT OF UNIAXIAL OPTICAL MEDIA
Marilyn J. Dodge, I. H. Malitson, and A. I. Mahan (JPL) *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 80-82 refs Repr. from Appl. Opt., v. 8, Aug. 1969 p 1703-1705 (For availability see N74-20250 11-23)

A method was developed for measuring the refractive index of optical glasses and uniaxial crystalline solids when established refractometric methods are not feasible. A synthetic ruby cuboid was contacted to a prism of known refractive index and a spectrometer was used to measure the angles describing the optical path through the ruby-glass combination. Ray tracing equations were derived to compute the refractive index accurate to within 0.00003. Index values for both polarizations of ruby are given at selected wavelengths from 0.4358 microns to 0.7065 microns. Author

N74-20262 National Bureau of Standards, Washington, D.C.
AN APPARATUS FOR PHOTOGRAPHING INTERFERENCE PHENOMENA c14
James B. Saunders *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 85-118 refs Repr. from J. Res. Natl. Bur. Stand., v. 35, Sep. 1945 p 157-186 (For availability see N74-20250 11-23)
(NBS-RP-1668)

A photographic instrument is described that was designed for recording the changes produced in the order of interference fringes over long periods and for recording large changes in the order of interference. When this instrument is used with interferometric systems for studying the changes caused in transparent solids by heating, it can be made to yield a continuous record of the simultaneous changes in temperature, time, index, strain, and density. To record the expansion of a material that is being heated from room temperature to 500 C. at a rate of 3 degrees centigrade per minute, requires approximately 1 foot of 35-millimeter film. Thus, even very long tests require such a small amount of film that the operator is able to process it in any small dark room. The fringes are photographed at their natural size, and the fringe shifts can be determined from the photographic record without the use of enlarging or projection equipment. Author

N74-20263 National Bureau of Standards, Washington, D.C.
PRECISE TOPOGRAPHY OF OPTICAL SURFACES
James B. Saunders *In its* Precision Meas. and Calibration,

Vol. 10 Nov. 1973 p 119-126 refs Repr. from J. Res. Natl. Bur. Stand., v. 47, no. 3, Sep. 1951 p 148-155 Presented at the meeting of the Opt. Soc. of Am., Mar. 1950 (For availability see N74-20250 11-23)
(NBS-RP-2239)

The unit of length usually used in measuring optical surface features, by interference of light, is one-half the wavelength of the monochromatic light that is used. A method is described in which the unit of length is a much smaller fraction of the wavelength. Topographic maps of optical surfaces are made in which the contour interval is less than one-thirtieth the wavelength. The smallness of the unit depends upon the quality of the surfaces. Irregularities, too small to be detected with the Fizeau or two-beam fringes, are made to appear very prominent. Surface markings, caused by the final polishing actions, can be made to stand out in bold relief. Author

N74-20264 National Bureau of Standards, Washington, D.C.
IN-LINE INTERFEROMETER c14
James B. Saunders *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 127-128 ref Repr. from J. Opt. Soc. Am., v. 44, no. 3, Mar. 1954 p 241-242 (For availability see N74-20250 11-23)

An interferometer is described for the measurement of beam dividing surfaces. The apparatus consists essentially of the elements for a Twyman-Green interferometer. The end mirrors are made of optical glass and the reflecting surfaces of these mirrors transmit a part of the beam. The advantages of the instrument are (1) a sensitivity (n+1) times that of the Fizeau viewer, which is usually used for this test, (2)compactness, and (3)ruggedness. Author

N74-20265 National Bureau of Standards, Washington, D.C.
TESTING OF LARGE OPTICAL SURFACES WITH SMALL TEST PLATES
James B. Saunders *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 129-134 refs Repr. from J. Res. Natl. Bur. Stand., v. 53, no. 1, Jul. 1954 p 29-34 (For availability see N74-20250 11-23)
(NBS-RP-2514)

A procedure for testing large optical surfaces with relatively small optical standards is described. Simplified formulas are used to apply a statistical method for obtaining increased precision. A practical example is used to illustrate the procedure for testing surfaces that may be assumed to have revolution symmetry. Author

N74-20266 National Bureau of Standards, Washington, D.C.
PARALLEL TESTING INTERFEROMETER c14
James B. Saunders *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 135-142 refs Repr. from J. Res. Natl. Bur. Stand., v. 61, no. 6, Dec. 1958 p 491-498 (For availability see N74-20250 11-23)
(NBS-RP-2917)

The conventional methods of testing the parallelism of opaque bodies, such as gage blocks, by interferometry require wringing of the body to an optical flat. This operation disturbs the temperature equilibrium, necessitating long periods between tests, esnecially for long blocks. It often injures the surfaces of both the optical flat and the test body. Also, if the body is a standard gage block, repeated wringings during use ultimately change the dimension. An interferometer is described for measuring the parallelism of gage blocks and other bodies of any reasonable length without the necessity of the wringing operation. Two forms of this instrument are used - one for testing long blocks and another for testing short blocks. Either form can be constructed for testing blocks of any length, but two forms are found to be more practical. Author

N74-20267 National Bureau of Standards, Washington, D.C.
INTERFEROMETER FOR LARGE SURFACES c14
James B. Saunders and Franz L. Gross *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 143-145 refs Repr. from J. Res. Natl. Bur. Stand., v. 62, no. 4, Apr. 1959 p 137-139 (For availability see N74-20250 11-23)
(NBS-RP-2943)

An interferometer is described that permits the testing of large areas, such as layout plates. The extension to large areas is obtained by causing a collimated beam of light to reflect from the specimen at a large angle of incidence. The resultant fringe pattern is a contour map of the surface relative to an arbitrarily chosen plane and the contour interval is a function of wavelength and angle of incidence. Author

N74-20268 National Bureau of Standards, Washington, D.C.
MEASUREMENT OF WAVE FRONTS WITHOUT A REFERENCE STANDARD: PART 1. THE WAVE-FRONT-SHEARING INTERFEROMETER c14
James B. Saunders *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 146-152 refs Repr. from J. Res. Natl. Bur. Stand., B. Math. Math. Phys., v. 65B, no. 4, Oct.-Dec. 1961 p 239-244 (For availability see N74-20250 11-23)

The wave-front-shearing interferometer may be used to test any converging wave front regardless of whether or not it is symmetrical. A mathematical operation is described that permits complete analysis of the data. This operation yields values of the deviations of wave fronts under test from a close fitting sphere. The reference surface may be chosen statistically so that the results are the deviations from a best fitting sphere. Author

N74-20269 National Bureau of Standards, Washington, D.C.
MEASUREMENT OF WAVE FRONTS WITHOUT A REFERENCE STANDARD: PART 2. THE WAVE FRONT-REVERSING INTERFEROMETER c14
James B. Saunders *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 153-164 refs Repr. from J. Res. Natl. Bur. Stand., B. Math. Math. Phys., v. 66B, no. 1, Jan.-Mar. 1962 p 29-40 (For availability see N74-20250 11-23)
(Paper-66B1-70)

Interferometers permitting the measurement of shape and altered distribution of fringes are usually used to compare either an unknown wave front with a known one or an unknown surface with a standard reference surface. Any error in the reference surface introduces a corresponding error in the results sought. An absolute measuring interferometer is described along with the associated mathematical operations necessary for analysis of the data. The reference surface is purely mathematical in nature and is therefore free from error. Deviations of converging wave fronts from perfect spheres, paraboloids or ellipsoids are readily measured without the use of tangible reference surfaces. The equation of the reference surface may contain one or more parameters whose value is sought. Thus, the eccentricity of the conicoid that best fits a mirror and deviations of the surface from the true mathematical curve are obtained simultaneously. The sensitivity of the test can be varied so that when testing large aspherical elements which depart very far from spheres the number and width of the fringes can be adjusted to any desired values. Author

N74-20270 National Bureau of Standards, Washington, D.C.
WAVE FRONT SHEARING PRISM INTERFEROMETER c14
James B. Saunders *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 165-181 refs Repr. from J. Res. Natl. Bur. Stand., C. Eng. and Instr., v. 68C, no. 3, Jul.-Sep. 1964 p 155-171 (For availability see N74-20250 11-23)
(Paper-68C3-160)

A small prism interferometer is described that is a modification of the Bates' wave front shearing interferometer. The prism is small, rugged, and versatile. The shape of any converging wave front from any optical element or compound instrument may be measured with this instrument. Several variations of the prism are described that have characteristic properties. Special features are introduced for eliminating spherical aberration effects, for producing fringes of different characteristics, and for testing all wave fronts. Details for making and adjusting the prisms are given. Examples are given for interpreting the interferograms. Author

N74-20271 National Bureau of Standards, Washington, D.C.
A SIMPLE, INEXPENSIVE WAVEFRONT SHEARING INTERFEROMETER c14
J. B. Saunders *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 182-184 refs Repr. from Appl. Opt., v. 6, Sep. 1967 p 1581-1583 (For availability see N74-20250 11-23)

Potential use of a beam divider as a wave front shearing interferometer is analyzed. The beam divider is made by cementing together the hypotenuse faces of two right angle prisms, one of which is half silvered. Source size limitations to be used with the interferometer are given. E.H.W.

N74-20272 National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
AN INTERFEROMETER FOR MEASURING GRADIENTS IN BOTH REFRACTIVE INDEX AND THICKNESS OF LARGE OR SMALL OPTICS c14
J. B. Saunders *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 185-188 refs Repr. from J. Res. Natl. Bur. Stand., C, v. 73C, no. 1 and 2, Jan.-Jun. 1969 p 1-4 (For availability see N74-20250 11-23)
(Paper-73C-1/2-283)

A small aperture prism interferometer is described for measuring refractive index and thickness gradients between pairs of adjacent points in both small and large optics. It is relatively free from vibration problems and thermal gradients are reduced to a minimum by confining the two component beams of light to a relatively small space. Large specimens are tested by scanning them with the light beam. Author

N74-20273 National Bureau of Standards, Washington, D.C. Metrology Div.
HIGH SPEED HOLOGRAPHIC INTERFEROMETRY c16
A. T. Funkhouser and K. D. Mielenz *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 189 refs Repr. from Appl. Opt., v. 9, May 1970 p 1215-1570 (For availability see N74-20250 11-23)

A combination of holographic interferometer and high speed photography was used to obtain a continuous time resolved record of dynamic distortion, caused by absorption of optical pump energy, in ruby laser rods. Advantages and disadvantages of the technique are given. Author

N74-20274 National Bureau of Standards, Washington, D.C.
MEASUREMENT OF THE SECOND-ORDER DEGREE OF COHERENCE BY MEANS OF A WAVEFRONT SHEARING INTERFEROMETER
D. N. Grimes *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 190-193 refs Repr. from Appl. Opt., v. 10, Jul. 1971 p 1567-1570 (For availability see N74-20250 11-23)

A method of measuring the second order degree of coherence in an arbitrary plane by means of a compact wave front shearing interferometer is described. The prism interferometer previously described produces two sheared images that interfere, allowing measurement of the degree of spatial coherence. If the degree of coherence is a function of coordinate differences only, the visibility is constant; otherwise it varies over the field. Experimental results are given. Author

N74-20275 National Bureau of Standards, Washington, D.C.
OPTICAL IMAGE EVALUATION
In its Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 197-492 refs Repr. from NBS-Circ-526, 29 Apr. 1954 p 1-289 Presented at the Proc. of the NBS Semicentennial Symp. on Opt. Image Evaluation, Washington, D. C. 18-20 Oct. 1951 (For availability see N74-20250 11-23)
(NBS-Circ-526)

Engineering knowledge and its role in image evaluation is examined. Data cover optical design, effects of geometrical aberrations on the performance of optical systems, and geometrical and physical optics. E.H.W.

N74-20276 Imperial Coll. of Science and Technology, London (England).
LIGHT DISTRIBUTION IN THE IMAGE OF AN INCOHERENTLY ILLUMINATED EDGE
W. Weinstein *In* NBS Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 493-498 refs Repr. from J. Opt. Soc. Am., v. 44, no. 8, Aug. 1954 p 610-615 (For availability see N74-20250 11-23)

The image of an incoherently illuminated edge is shown to have a simple structure with no diffraction fringes for any state of correction of the imaging system. The light distribution in the defocused image is calculated and numerical results are given. A comparison is made with the predictions of geometrical optics. Author

N74-20277 National Bureau of Standards, Washington, D.C.
VARIATION IN DISTORTION WITH MAGNIFICATION
Arthur A. Magill *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 499-506 ref Repr. from J. Res. Natl. Bur. Stand., v. 54, no. 3, Mar. 1955 p 135-142 (For availability see N74-20250 11-23)
(NBS-RP-2574)

The distortion introduced in the image by a lens for a given axial inclination of the chief ray is a linear function of the magnification. Specifically, if D sub 0 represents the distortion with parallel light incident on one side of the lens (zero magnification) and D sub infinity the distortion with parallel light incident on the other, then the distortion Dm at any magnification m is given by D sub m = D sub 0 to the minus m power D infinity. This equation was experimentally verified for examples of three types of symmetrical lenses. Author

N74-20278 National Bureau of Standards, Washington, D.C.
CHARACTERISTICS OF AN IMAGE-FORMING SYSTEM
Roland V. Shack *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 507-522 refs Repr. from J. Res. Natl. Bur. Stand., v. 56, no. 5, May 1956 p 245-260 (For availability see N74-20250 11-23)
(NBS-RP-2672)

Two general approaches to the analysis of an image forming system are considered. One depends on the image of a point object and the other on the Fourier transform of this image. The two are developed independently and then coordinated, a practical characteristic function being determined for each approach. Relative merits of the two approaches are considered. Author

N74-20279 National Bureau of Standards, Washington, D.C.
OUTLINE OF PRACTICAL CHARACTERISTICS OF AN IMAGE-FORMING SYSTEM
Roland V. Shack *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 523-525 Repr. from J. Opt. Soc. Am., v. 46, no. 9, Sep. 1956 p 755-757 Presented at Symp. on Formation and Evaluation of Images, Rochester, N. Y., 15-18 Jun. 1955 (For availability see N74-20250 11-23)

The relationships between certain fundamental characteristic functions relating to an optical image-forming system are indicated, some being observable experimentally and others being unobservable. Of the observable characteristics two are especially useful in the analysis of the image forming properties of the system. One of these represents the image of a point object and the other the Fourier transform of this point image. The two are considered for their practicality as bases for objective laboratory techniques in image evaluation. The transform of the point image is practical as it stands whereas the point image itself is not. A function directly related to the point image and to a number of other simple objects is suggested as a practical representative function. The practical functions are correlated and the relative merits of the two approaches are considered. Author

N74-20280 National Bureau of Standards, Washington, D.C.
EVALUATION OF LENS DISTORTION BY VISUAL AND PHOTOGRAPHIC METHODS
Francis E. Washer, William P. Tayman, and Walter R. Darling *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 526-532 refs Repr. from J. Res. Natl. Bur. Stand., v. 61, no. 6, Dec. 1958 p 509-515 (For availability see N74-20250 11-23)
(NBS-RP-2920)

The evaluation of lens distortion by photographic and visual methods is discussed. Measurements made on a single lens using the two methods are reported. The precision of measurement of each method is determined which shows that the observed differences must be attributed to systematic error. Various sources of systematic error are considered. Uncompensated differential plate tipping is identified as the most probable cause of the observed differences. A method of correction is developed. It is concluded that when work is done with extreme care and with due account taken of various insidious sources of error, it is

possible to achieve comparable results with either method.
Author

N74-20281 National Bureau of Standards, Washington, D.C.
NOTE ON MEASUREMENT OF SINE-WAVE RESPONSE OF LENSES
Robert E. Stephens *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 533 ref Repr. from J. Opt. Soc. Am., v. 49, no. 4, Apr. 1959 p 413 (For availability see N74-20250 11-23)

The possibility of measuring the phase angle sine and cosine of lens sine wave response is evaluated. Author

N74-20282 National Bureau of Standards, Washington, D.C.
EQUIPMENT AND METHOD FOR PHOTOELECTRIC DETERMINATION OF IMAGE CONTRAST SUITABLE FOR USING SQUARE WAVE TARGETS c14
Fred W. Rosberry *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 534-541 refs Repr. from J. Res. Natl. Bur. Stand., C, v. 64C, no. 1, Jan.-Mar. 1960 p 57-64 (For availability see N74-20250 11-23)
(Paper-64C1-25)

Conventional measurements of the resolving power of lenses employ measuring photographs of test charts containing an array of accurately spaced parallel lines. This method has limited precision because of the variability of photographic emulsions and is time-consuming in operation. Previous work by others is extended in obviating these differences by using a direct photoelectric scanning of a line pattern image formed by the lens under test. Square wave high contrast resolving power targets with two different line pattern arrangements were used as test objects. The image was moved across a stationary slit and photomultiplier tube. The output was recorded as relative transmission. Author

N74-20283 National Bureau of Standards, Washington, D.C.
VARIATION OF RESOLVING POWER AND TYPE OF TEST PATTERN c14
Francis E. Washer and William P. Tayman *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 542-556 refs Repr. from J. Res. Natl. Bur. Stand., v. 64C, no. 3, Jul.-Sep. 1960 p 209-223 (For availability see N74-20250 11-23)
(Paper-64C3-39)

The plane of best average definition is located for a number of lenses of a type used in airplane mapping cameras. Three different types of test pattern are used for each lens. These patterns are the long-line, short-line, and annulus. Results of measurement that show the variation of resolving power throughout the region of usable imagery are given for each type of test pattern with two types of photographic emulsion. It is found that the plane of best average definition can be located equally well with each type of pattern. There are, however, pronounced differences in the numerical magnitudes of the values of resolving power determined with the various types of test pattern. In general, the highest values are attained with the long-line patterns. Values of the various rating indices are given together with a comparison of the different order of merit assigned by these indices. Author

N74-20284 National Bureau of Standards, Washington, D.C.
FOUR-COLOR ACHROMATS AND SUPERCHROMATS
Robert E. Stephens *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 557-560 Repr. from J. Opt. Soc. Am., v. 50, no. 10, Oct. 1960 p 1016-1019 (For availability see N74-20250 11-23)

Materials suitable for the construction of achromatic lenses corrected for four wavelengths are selected by the use of three graphs which are the three orthographic projections of a three-dimensional graph in P, Q, and V. One set of three glasses, Schott PKS-1, F-1, and KzFS-4, was selected, from which a four-color achromat was designed. Analysis at 12 wavelengths shows this design to have negligible residual chromatic aberration. It is consequently a superchromat in accordance with Herzberger's prediction. Author

N74-20285 National Bureau of Standards, Washington, D.C.
MAGNIFICATION OF A TELESCOPE c14
Robert E. Stephens *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 561-562 refs (For availability see N74-20250 11-23)

An attempt was made to solve the problem of relating image, object distances, and magnification to a system of two thin lenses in sequence. The system chosen for study consists of a converging lens followed by a diverging lens in the arrangement of a Galilean type telescope. Data are included on the position, size, and apparent size of the image formed by the telescopic system. E.H.W.

N74-20286 National Bureau of Standards, Washington, D.C.
MEASUREMENT OF CONTRAST IN THE AERIAL IMAGE
Fred W. Rosberry *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 563-567 refs Repr. from Photogrammetric Eng., Mar. 1961 p 155-159 Presented at the Soc. 26th Ann. Meeting, Washington, D. C., 23-26 Mar. 1960 (For availability see N74-20250 11-23)

The quality of a lens is evaluated by examining the image it produces and comparing it with the object or target of which the image is made. An instrument was developed which scans the aerial image directly with a slit and photomultiplier tube. The resultant variations in luminosity in the image are recorded on a moving chart paper. This process substitutes a linear receiver or phototube for a nonlinear receiver such as an emulsion. Results are shown in which contrast is plotted against image frequency for several f/values of a lens. A comparison is also made between image contrast and star images at several focal positions. A second comparison is made between measured contrast and best definition at several focal positions. Author

N74-20287 National Bureau of Standards, Washington, D.C.
LOCATION OF THE PLANE OF BEST AVERAGE DEFINITION WITH LOW CONTRAST RESOLUTION PATTERNS
Francis E. Washer and William P. Tayman *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 568-575 refs Repr. from J. Res. Natl. Bur. Stand., C, v. 65C, no. 3, Jul.-Sep. 1961 p 195-202 (For availability see N74-20250 11-23)
(Paper-65C3-71)

The plane of best average definition is located for each of several airplane camera lenses using two types of low contrast test patterns and two emulsions. A low contrast pattern composed of dark lines on a light background and the reverse pattern consisting of light lines on a dark background are used. The results of measurement indicate that the position of the plane of best focus and the numerical magnitudes of the root mean product mean value of the resolving power are not significantly affected by this reversal of contrast. In addition, the results obtained using low contrast targets are compared with those obtained with high contrast targets. Hence, the position of the selected focal plane remains invariant although the values of the measured resolving power are substantially higher for the high contrast targets. Author

N74-20288 National Bureau of Standards, Washington, D.C.
COMPARISON OF LENS RESPONSE FOR SINUSOIDAL AND SQUARE-WAVE TARGETS AT SEVERAL FOCAL POSITIONS
Sayeda H. Emara *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 576-583 refs Repr. from J. Res. Natl. Bur. Stand., A, v. 65A, no. 6, Nov.-Dec. 1961 p 465-472 (For availability see N74-20250 11-23)
(Paper-65A6-127)

A study was made of the sine wave and square wave responses of a lens at two apertures and several focal positions, both on- and off-axis. Two focal positions, one of which gives the best definition and the other the highest contrast for coarse patterns, were located precisely. At these focal positions and at several other arbitrarily chosen positions the sine wave and square wave responses were measured. Because of the scattering character of the photographically made target objects, a special technique was employed for calibrating the targets to obtain their contrast as seen by the lens under test. The results show that for large apertures of the lens there is some frequency at which the response (either sine or square) is the same for the two focal positions (curves cross). This phenomenon was further studied by computing the square wave response of the lens from its sine wave response; and it was found that there is

close agreement between the computed and experimentally determined responses. Author

N74-20289 National Bureau of Standards, Washington, D.C.
MEASUREMENT OF LONGITUDINAL SPHERICAL ABERRATION IN THE EXTRA-AXIAL REGION OF LENSES
Francis E. Washer and Walter R. Darling *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 584-594 ref Repr. from J. Res. Natl. Bur. Stand., C, v. 66C, no. 3, Jul.-Sep. 1962 p 185-195 (For availabiiity see N74-20250 11-23)
(Paper-66C3-95)

A method of measuring longitudinal spherical and chromatic aberration in the extra-axial region of lenses is described. The method employs an especially constructed optical T-bench equipped with nodal slide and angle measuring telescope. The determinations are based upon measurements of angular deviations in selected small regions of the collimated beam emergent from the lens under test. The underlying theory of the method is presented together with a brief description of the apparatus used and technique of measurement. Results of measurement on three lenses are included. Author

N74-20290 National Bureau of Standards, Washington, D.C.
BIPRISM METHOD OF DETERMINING THE EQUIVALENT FOCAL LENGTH OF FLAT FIELD LENSES
Walter R. Darling *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 595-598 ref Repr. from J. Res. Natl. Bur. Stand., C, v. 66C, no. 4, Oct.-Dec. 1962 p 313-316 (For availability see N74-20250 11-23)
(Paper-66C4-106)

A device is described that permits the rapid determination of the equivalent focal length of a lens. A transmitting biprism mounted between a collimated light source and a lens, divides the light incident upon the front of the lens into two parallel beams making a fixed angle with one another. On passing through the lens, two images are formed in the focal plane. The magnitude of the lateral separation of the images is determined by the angular separation of the two incident beams and the focal length of the lens. The focal length of the imaging lens may be determined from the measured separation of the images at the focal plane of the lens and the known angle of deviation of the two incident beams produced by the biprism. Author

N74-20291 National Bureau of Standards, Washington, D.C.
CALIBRATION OF PHOTOGRAMMETRIC LENSES AND CAMERAS AT THE NATIONAL BUREAU OF STANDARDS
Francis E. Washer *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 599-605 refs Repr. from Photogrammetric Eng., Jan. 1963 p 113-119 (For availability see N74-20250 11-23)

A summary of calibrations performed at the National Bureau of Standards on lenses and cameras that are used in precise photogrammetric work is given. A brief description was also given of the photographic and visual calibrations most frequently required. A list of publications by members of the NBS staff that pertain to problems of lens and camera calibration is included. Author

N74-20292 National Bureau of Standards, Washington, D.C.
DETERMINATION OF OPTICAL PATH DIFFERENCE FOR A PHOTOGRAPHIC OBJECTIVE
Francis E. Washer and Walter R. Darling *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 606-613 refs Repr. from J. Res. Natl. Bur. Stand., C, v. 67C, no. 4, Oct.-Dec. 1963 p 311-318 (For availability see N74-20250 11-23)
(Paper-67C4-142)

A method of measuring longitudinal spherical aberration and optical path differences by a direct visual means is described. The method employs a nodal slide optical bench and a movable-slit system. The underlying theory of the method is presented together with a brief description of the apparatus used. The results of measurement on a typical lens and a procedure for checking the consistency of measurements are included. Author

N74-20293 National Bureau of Standards, Washington, D.C.
EXPERIMENTAL VERIFICATION OF SUPERACHROMATISM
Robert E. Stephens *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 614-615 refs Repr. from J. Opt. Soc. Amer., v. 56, no. 2, Feb. 1966 p 213-214 (For availability see N74-20250 11-23)

A five element prism has been designed and constructed from three types of Schott glass to verify superachromatism experimentally by deviating a beam of light approximately 30 degrees without dispersion or distortion. When tested on a spectrometer, viewing a narrow slit with a telescope magnification of approximately 30 times, no dispersion could be seen. Pointings on 7 isolated spectrum lines separated by a monochromator show a maximum dispersion of 3 sec, 1 part in 36000. Author

N74-20294 National Bureau of Standards, Washington, D.C.
CONDITION FOR MICRODENSITOMETER LINEARITY
Richard E. Swing *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 616-624 refs Repr. from J. Opt. Soc. Amer., v. 62, no. 2, Feb. 1972 p 199-207 (For availability see N74-20250 11-23)

A simple microdensiometer system is analyzed using the principles and analytical techniques of the theory of partial coherence. A specification of the physical conditions under which the instrument is linear is obtained for incoherent illumination. The illuminating mutual intensity is then generalized by the Van Cittert-Zernike theorem, and conditions on the partial coherence of the preslit illumination necessary for effective incoherence are determined. The new conditions determine a mode of linear operation for the microdensitometer for which an optical transfer function may be unambiguously defined. Author

N74-20295 National Bureau of Standards, Washington, D.C.
LINEAR MICRODENSITOMETRY
D. N. Grimes *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 625 refs Repr. from J. Opt. Soc. Amer., v. 61, no. 9, Sep. 1971 p 1263 (For availability see N74-20250 11-23)

The microdensitometer system is proposed where the sample is illuminated by the focused image of the slit and approximately all of the transmitted light is collected on the other side. Hence, the system essentially measures singly diffuse density rather than specular density. The advantages of this system are: (1) The output is independent of the partial coherence of the source; (2) fewer .ocusing and alignment problems; (3) improved over-all system transfer function because there is no sampling slit; and (4) measurement of singly diffuse density makes interlaboratory comparisons easier. Author

N74-20296 National Bureau of Standards, Washington, D.C.
IMAGING OF TRI-BAR TARGETS AND THE THEORETICAL RESOLUTION LIMIT IN PARTIALLY COHERENT ILLUMINATION
D. N. Grimes *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 626-632 refs Repr. from J. Opt. Soc. Amer., v. 61, no. 7, Jul. 1971 p 870-876 (For availability see N74-20250 11-23)

In viewing systems that employ critical, Kohler, or collimated illumination, the illumination may frequently be characterized by the complex degree of coherence in the form of a first order Bessel function divided by its argument. The anomalies that occur in the image of a tri-bar target viewed in partially coherent illumination of this form are discussed for a two dimensional circular diffraction-limited imaging system. The Sparrow criterion, which in this case correlates with experimental measurements of resolving power, is applied to determine the resolution limit. The computed resolution limit curve for a tri-bar target is shown and compared to the previously published two point resolution limit curve for a one dimensional system and to the limiting values obtained in a two dimensional system for coherent and incoherent illumination. In the latter case, the full curve is shown as a special case of the application of the Sparrow criterion to the partially coherent imaging equations for a circular two dimensional system. Experimental confirmation of the calculation is given. Author

N74-20297 National Bureau of Standards, Washington, D.C.
OPTICAL AUTOCORRELATOR WITH SPECIAL APPLICATION TO MTF MEASUREMENT c14
D. N. Grimes *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 633-637 refs Repr. from Appl. Opt., v. 11,

Apr. 1972 p 914-918 (For availability see N74-20250 11-23)

An optical autocorrelator is described which is based on a modified Sagnac two mirror interferometer that operates in the zero fringe mode. The real time radiant flux output is the square of the autocorrelation of the aperture function. In a particular application, when the aperture function is the pupil function of a lens under test, the autocorrelator output is the MTF of the lens. The system is not limited in focal length; aperature size is limited only by the sizes of the beam splitters and mirrors. Experimental results are given with comparison data for both infinite conjugate MTF and the autocorrelation of an annular aperture. Methods of adapting the system for measurement of the phase of the transfer function and for finite conjugate testing are also described.

Author

N74-20298 National Bureau of Standards, Washington, D.C.
FILTERS FOR THE REPRODUCTION OF SUNLIGHT AND DAYLIGHT AND THE DETERMINATION OF COLOR TEMPERATURE

Raymond Davis and K. S. Gibson *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 641-805 refs Repr. from NBS Misc. Publ. No. 114, 21 Jan. 1931 p 1-165 (For availability see N74-20250 11-23)
(NBS-M-114)

A large number of filters have been developed for use in photographic sensitometry, colorimetry, and photometry. They consist of a 2-compartment cell with three borosilicate crown glass windows, the two compartments being filled with solutions. The design of the filters has been based upon extensive spectrophotometric measurements of the component solutions and cell, and upon methods of computation giving accurate color matches and relatively good spectral energy matches between the source and filter combination and the energy distribution.

Author

N74-20299 National Bureau of Standards, Washington, D.C.
A NOMOGRAPH FOR SELECTING LIGHT BALANCING FILTERS FOR CAMERA EXPOSURE OF COLOR FILMS
c14

C. S. McCamy *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 806-808 refs Repr. from Photogr. Sci. Eng., v. 3, no. 6, Nov.-Dec. 1959 p 302-304 Presented at Natl. Conf., Chicago, Oct. 1959 (For availability see N74-20250 11-23)

A nomograph has been designed for rapid selection of filters to adjust the spectral quality of the illumination to the spectral sensitivity of the film for color photography. The nomograph provides for a very large number of combinations of films and light sources in a simple form, permits the easy interpolation of new films, light sources, or filters, indicates which filters would nearly satisfy when an ideal filter is not available, indicates the general nature of abnormal combinations for special effects, and provides a convenient conversion from color temperature to reciprocal color temperature. The nomograph is based on the assumption that the color balance of color films, the chromaticity of the illumination, and the effect of filters can be characterized adequately on a scale of reciprocal color temperature and that the change of reciprocal color temperature by a given filter is a constant.

Author

N74-20300 National Bureau of Standards, Washington, D.C.
TECHNIQUES FOR RULING AND ETCHING PRECISE SCALES IN GLASS AND THEIR REPRODUCTION BY PHOTOETCHING WITH A NEW LIGHT-SENSITIVE RESIST
c15

Raymond Davis and Chester I. Pope *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 809-846 refs Repr. from NBS Circ. No. 565, 26 Aug. 19-55 p 1-36 (For availability see N74-20250 11-23)
(NBS-Circ-565)

Two methods are described for the making of very precisely graduated circles for theodolites. In one method the graduations and numbers are ruled in a wax resist coated on the glass circle by means of a ruling engine followed by etching. In the other method the circle is coated with a light sensitive resist and exposed in contact with a glass master negative followed by etching. The requirements of precise circles and the mechanics of engraving the resist on both circles and reticules are discussed. The development of resist coatings and their application on the glass and the methods of glass etching are reviewed. A new mild etching solution containing phosphoric acid and hydrofluoric acid was developed. The synthesis of phenol formaldehyde resin for use as a light sensitive resist coating and the procedure for its use are given in detail.

Author

N74-20301 National Bureau of Standards, Washington, D.C.
DEVELOPMENT OF A PHOTORESIST FOR ETCHING DESIGNS IN GLASS
c15

Chester I. Pope and Raymond Davis *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 847-850 refs Repr. from J. Res. Natl. Bur. Stand., v. 55, no. 3, Sep. 1955 p 139-142 (For availability see N74-20250 11-23)
(NBS-RP-2612)

The preparation of a light sensitive coating from phenol formaldehyde resin is described. The light sensitive coating may be used as a resist or mask in etching scales or reticule patterns in glass. A new etching solution was developed for use with this resist, and it is also recommended for fine line etching with wax resists.

Author

N74-20302 National Bureau of Standards, Washington, D.C.
PHOTOGRAPHIC IMAGE STRUCTURE EVALUATION
c14

C. S. McCamy *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 851-859 refs (For availability see N74-20250 11-23)

The psychophysical basis of several of the measures of image quality is discussed. The measurement of optical densities by microdensitometers depends on the geometric distribution of the flux incident on the sample, the geometric distribution of the sensitivity of the optical system which receives the flux, the spectral distribution of the incident flux, and the spectral sensitivity of the receiver system. Terminology and notation for describing such measuring systems are being considered for standardization. It is emphasized that measurements must be related to applications as the characteristics of optical and photographic systems contribute to image quality.

G.G.

N74-20303 National Bureau of Standards, Washington, D.C.
THE NBS MICROCOPY RESOLUTION TEST CHART

Bernard H. Fouquet *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 860-867 (For availability see N74-20250 11-23)

A resolution chart for measuring the resolving power of microfilming systems is presented. This chart is made up of 21 patterns ranging in spatial frequency from 1.0 to 10 lines per millimeter. Recently, the master negatives used in the production of the chart were completely remade. This presented the opportunity to make certain desirable changes in the interest of standardization and efficiency of production, but the principal design features have been retained. Measurements for the negatives and the resulting charts indicate that an accuracy of two percent is obtained in pattern line width and frequency. The use of the chart is reviewed and the instructions issued with the charts are appended.

Author

N74-20304 National Bureau of Standards, Washington, D.C.
THE PRODUCTION OF PHOTOGRAPHIC EDGES OF EXTREME SHARPNESS
c14

Calvin S. McCamy and Myron A. Berkovitz *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 35-36 Repr. from SPSE Conf.: Frontiers of Photo., May 1965 p 35-36 (For availability see N74-20250 11-23)
(Paper-21)

Edge test objects of high sharpness are useful for the measurement of acutance and the edge spread function of photographic materials, and the edge response of camera systems and microdensitometers. It was known that if a fine knife edge exposure could be made on a piece of film by any method whatsoever, this film could be used as the knife edge for exposures of test materials. Edges of this kind were produced by clamping a piece of thin metal foil between two pieces of tool steel, then grinding and lapping this sandwich. The foil was then placed in tight contact with a very fine-grain film and exposed to soft X-rays. Microdensitometer traces of this photographic edge showed it to be superior to edges obtained by all other methods tried. Tantalum foil .01 inch thick was used to make the metal

edge. Tantalum was chosen for the metal edge because of its density, mass absorption coefficient for soft X-rays, and machining characteristics. Author

N74-20305 National Bureau of Standards, Washington, D.C.
ON THE INFORMATION IN A MICROPHOTOGRAPH c14
C. S. McCamy *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 470-476 refs Repr. from Appl. Opt., v. 4, Apr. 1965 p 405-411 (For availability see N74-20250 11-23)

The information concentration of a legible microphotograph made at a reduction ratio of 1200 is computed to be over 2 x 1 million bits/ sq mm. Reasons are adduced for using a mosaic of squares having sides equal to the reciprocal of the resolving power, each being capable of assuming one of two density ranges, as a model of a high contrast material for the computation of information capacity. It follows that the information capacity is equal to the square of the resolving power. This relation gives values of information capacity in good accord with the values computed by the Jones theory. The information capacity of a Kodak high resolution plate is computed to be 3.25 x 1 million bits/sq mm. That the product of reduction ratio times quality index equals the product of resolving power times the height of the lower case in type to be copied is verified at the high reduction ratio, and this relationship is considered useful for engineering computations involving the copying of commonly used styles of type. Author

N74-20306 National Bureau of Standards, Washington, D.C.
NEW PRINCIPLE OF ABSOLUTE PHOTOMETRY c14
Calvin S. McCamy *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 877 Repr. from JOSA, v. 53, no. 4, Apr. 1963 p 511 (For availability see N74-20250 11-23)

For absolute photometry, a standard source, photometric comparator, and quantitative attenuator are required. The principle of attenuation presented here is an optical analog of Riemann integration. A rectangular aperture in a light path is fitted with a sliding straight edged shutter. The light flux through the aperture is then approximately proportional to the open aperture area. A thin slit is moved across the aperture while the light passing through the slit to a detector is compared to a constant source. If the response of the detector is constant as the slit moves, the shutter is replaced, and the flux through the aperture to the detector is known to be proportional to shutter displacement which can be measured precisely. Author

N74-20307 National Bureau of Standards, Washington, D.C. Refractometry and Photography Section.
CONCEPTS, TERMINOLOGY, AND NOTATION FOR OPTICAL MODULATION
C. S. McCamy *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 878-889 refs Repr. from Photogr. Sci. Eng., v. 10, no. 6, Nov. - Dec. 1966 p 314-325 (For availability see N74-20250 11-23)

Reflectance, transmittance, and optical density are regarded as kinds of flux modulation factors. Transmittance is defined as the ratio of transmitted flux to the incident flux, while transmittance factor is here defined for an optical system as the ratio of the emergent flux with the sample in the system to the emergent flux with the sample removed. Transmission density is defined as the negative logarithm of transmittance factor. Reflection, transmission, and fluorescence are considered generically as propagation and generalized modulation terms are proposed. A coordinate system and functional notation are adopted to systematize the description of optical systems which use or measure modulation. Simplified notation of the form D(g;S:g';S') describes most cases. Terms, symbols, and notation are proposed for standardization. Author

N74-20308 National Bureau of Standards, Washington, D.C.
DETERMINATION OF RESIDUAL THIOSULFATE IN PROCESSED FILM c14
Chester I. Pope *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 890-898 refs Repr. from J. Res. Natl. Bur. Stand., C, v. 67C, no. 3, Jul.-Sep. 1963 (For availability see N74-20250 11-23)
(Paper-67C3-134)

The reaction of thiosulfate with mercuric chloride is the usual test for residual thiosulfate in processed film. Qualitative tests show that part of the precipitate remains in the gelatin layer of the film, causing the reported concentration of thiosulfate to be too low. A new test procedure was developed which also employs mercuric chloride as the precipitant but which reveals 2 to 3 times as much residual thiosulfate. Residual silver causes the formation of additional turbidity which is determined as residual thiosulfate. The addition of a known amount of gelatin to the test solution masked the effect of dissolved gelatin, making it possible to prepare one calibration curve for all types of film. A new method of measuring the residual silver in processed film was developed. A photoelectric nephelometer was used to measure the turbidity. Author

N74-20309 National Bureau of Standards, Washington, D.C.
INSPECTION OF PROCESSED PHOTOGRAPHIC RECORD FILMS FOR AGING BLEMISHES c14
C. S. McCamy *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 899-912 refs Repr. from NBS Handbook 96, 24 Jan. 1964 p 1-11 (For availability see N74-20250 11-23)
(NBS-Handbook-96)

Inspections of microfilms have recently revealed blemishes which apparently developed 2 to 20 years after the films were processed. Most of the blemishes are small spots, usually reddish or yellowish in color, ranging from about 15 to 150 microns across. These blemishes have been classified on the basis of size, shape, color, and character. This publication describes and gives colored illustrations of the various types, describes the method of observing them, and recommends sampling procedures for microfilm inspectors. Author

N74-20310 National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
BLEMISH FORMATION IN PROCESSED MICROFILM c14
C. I. Pope *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 913-321 refs Repr. from J. Res. Natl. Bur. Stand., A, v. 72A, no. 3, May-Jun. 1968 p 251-259 (For availability see N74-20250 11-23)
(Paper-72A3-499)

Oxidizing and reducing agents generated by paper cartons during storage may react with the image silver to form blemishes. The type of fixing bath, concentration of chlorine in the wash water, washing time and composition of the storage cartons can be factors that accelerate or retard the attack of the peroxide on the image silver. During storage, some storage cartons evolved formaldehyde, formic acid, and ammonia which created a chemical environment favorable for blemish formation in microfilm in the presence of peroxide. A correlation was found between the incidence of blemishes and the brand of paper storage cartons. A procedure was developed for testing processed microfilm to determine its susceptibility to blemish formation. According to the present theory, peroxide reacts with the silver in the image, forming colloidal silver which imparts a yellowish or reddish color to the blemishes. Author

N74-20311 National Bureau of Standards, Washington, D.C. Image Optics and Photography Section.
A SIMPLIFIED METHOD FOR DETERMINING RESIDUAL THIOSULFATE IN PROCESSED MICROFILM c14
C. I. Pope *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 922-923 refs Repr. from Photogr. Sci. Eng., v. 13 no. 5, Sep.-Oct. 1969 p 278-279 (For availability see N74-20250 11-23)

In the silver nitrate test for residual thiosulfate in processed film the silver ion reacts quantitatively with thiosulfate to form silver sulfide in situ. The excess silver ion is removed by treating the sample in solutions of sodium chloride and sodium thiosulfate followed by washing. The method is simplified by using a solution of ammonium hydroxide and sodium chloride to remove the excess silver ion; no washing is necessary. The new method takes half the time previously required. Author

N74-20312 National Bureau of Standards, Washington, D.C.
REDOX BLEMISHES: THEIR CAUSE AND PREVENTION c14
C. S. McCamy and Chester I. Pope *In its* Precision Meas. and Calibration, Vol. 10 Nov. 1973 p 924-929 refs Presented at Natl. Microfilm Assoc., Boston, 7 May 1969 (For availability

see N74-20250 11 23)

Small spots and character associated defects on some microfilm are investigated by a variety of techniques. The blemishes result from the displacement of image silver by an oxidation-reduction reaction caused by peroxides and other gaseous products of degradation of the paper cartons in which the films are stored. A method of producing blemishes for test purposes is developed. Recommendations cover the materials, processes, and storage conditions for microfilm preservation of records of permanent value. Author

N74-20313*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A SIMPLIFIED HOLOGRAPHIC-INTERFEROMETRY TECHNIQUE FOR REAL-TIME FLOW VISUALIZATION AND ANALYSIS

Shiela Ann T. Long and Robert C. Spencer Washington Mar. 1974 39 p refs

(NASA-TN-D-7421; L-9114) Avail: NTIS HC $3.25 CSCL 20D

A holographic-interferometry technique for flow visualization and analysis that produces real-time moire fringes is described from both experimental and application considerations. It has three chief advantages: real-time data for continuous observation and photography, ease of optical adjustment, and capability of using ordinary-glass test-section windows without affecting the results. A theoretical discussion is presented describing the formation of the fringes in holographic terms and then comparing this result to that which is obtained from a conventional moire approach. A discussion on obtaining density information from the fringe pattern is also included. Author

N74-20314*# Stanford Univ., Calif. W. W. Hansen Lab. of Physics.

THEORETICAL AND EXPERIMENTAL INVESTIGATIONS OF COLLECTIVE MICROWAVE PHENOMENA IN SOLIDS Final Report, Apr. 1966 - Dec. 1972

G. S. Kino Mar. 1973 12 p refs

(Grant NGL-05-020-165)

(NASA-CR-138980; SU-ML-2157) Avail: NTIS HC $4.00 CSCL 20N

Methods of generating microwave shear waves efficiently were studied. A new technique of mode conversion from a longitudinal wave to a shear wave was investigated and virtually 100% conversion efficiency could be obtained. Several aspects of Gunn oscillators were studied. One involved the detailed study of domains in Gunn oscillators using long samples of bulk gallium arsenide. Several new techniques were devised for measuring the properties of the domains. A fundamental theory of the efficiency of a Gunn oscillator was worked out. A computer program was devised to study the transient effect of domains passing through Gunn diodes. Some of the first planar epitaxial Gunn oscillators were made using liquid epitaxial material grown by liquid phase techniques on semi-insulating substrate. A new theory which predicted the properties of RF signals propagating in a thin film layer of GaAs was developed. The theory of the operation of a traveling wave amplifier is described. Author

N74-20315*# Martin Marietta Aerospace, Denver, Colo. Space Physics Lab.

DEVELOPMENT STUDY OF THE X-RAY SCATTERING PROPERTIES OF A GROUP OF OPTICALLY POLISHED FLAT SAMPLES Phase 2 Final Report

Joseph F. Froechtenigt Feb. 1974 82 p refs

(Contract NAS5-23198)

(NASA-CR-132939; MCR-73-333) Avail: NTIS HC $7.25 CSCL 20F

Four optically polished flat samples were tested at wavelengths of 8.34 A, 13.3 A, and 44 A and 0.5 deg, 0.92 deg, 1.5 deg, 2.0 deg and 4.0 deg angle of incidence. The four samples were also tested at 8.34 A and 0.92 deg angle of incidence for three additional angular orientations about an axis normal to the sample surface: 45 deg, 90 deg and 180 deg from the 0 deg position. The tests indicate that the scattering was greater at 44 A than at 13.3 A and 8.34 A. The orientation tests indicated that no great irregularities were present. Author

N74-20316*# General Electric Co., Schenectady, N.Y. Corporate Research and Development.

STUDY OF RESONANCE LIGHT SCATTERING FOR REMOTE OPTICAL PROBING

C. M. Penney, W. W. Morey, R. L. St. Peters, S. D. Silverstein, M. Lapp, and D. R. White Sep. 1973 136 p refs

(Contract NAS1-11624)

(NASA-CR-132363; SRD-73-125) Avail: NTIS HC $10.00 CSCL 20F

Enhanced scattering and fluorescence processes in the visible and UV were investigated which will enable improved remote measurements of gas properties. The theoretical relationship between scattering and fluorescence from an isolated molecule in the approach to resonance is examined through analysis of the time dependence of re-emitted light following excitation of pulsed incident light. Quantitative estimates are developed for the relative and absolute intensities of fluorescence and resonance scattering. New results are obtained for depolarization of scattering excited by light at wavelengths within a dissociative continuum. The experimental work was performed in two separate facilities. One of these utilizes argon and krypton lasers, single moded by a tilted etalon, and a 3/4 meter double monochromator. This facility was used to determine properties of the re-emission from NO2, I2 and O3 excited by visible light. The second facility involves a narrow-line dye laser, and a 3/4 meter single monochromator. The dye laser produces pulsed light with 5 nsec pulse duration and 0.005 nm spectral width. Author

N74-20317*# Linguistic Systems, Inc., Cambridge, Mass.

THE SPECTRAL DISTRIBUTION OF THE LUMINANCE COEFFICIENT OF THE SEA IN WATERS WITH DIVERSE OPTICAL PROPERTIES

E. N. Khalemskiy Washington NASA Nov. 1973 8 p Transl. into ENGLISH from the book "Optika Okeana i Atmosfery" Leningrad, Nauka Press, 1972 p 186-191

(Contract NASw-2482)

(NASA-TT-F-14785) Avail: NTIS HC $4.00 CSCL 20F

The hydrooptical characteristics which exert an influence on the coefficient of sea luminance are considered. These include the absorption index, the index of backward refraction, as well as the concentration of suspended particles in the sea water, thus the transparency of the water. The empirical results of spectral distribution and the dependence of the luminance coefficient on transparency are presented. Author

N74-20318*# Techtran Corp., Silver Spring, Md.

BASIC RELATIONSHIPS BETWEEN HYDROOPTICAL CHARACTERISTICS

M. V. Kozlyaninov Washington NASA Sep. 1973 27 p refs Transl. into ENGLISH from the publ. "Optika Okeana i Atmosfery" Leningrad, Nauka, 1972 p 5-24

(Contract NASw-2485)

(NASA-TT-F-14775) Avail: NTIS HC $4.50 CSCL 20F

Definitions are presented of the basic light field parameters in the sea and apparent hydrooptical characteristics. Based on the radiation transfer equation for the two-flux approximation, relationships are considered between inherent and apparent hydrooptical parameters. Author

N74-20319*# Scientific Translation Service, Santa Barbara, Calif.

DIFFUSION OF RADIATION IN A MEDIUM LIMITED BY A GLASSY SURFACE

S. D. Gutshabash Washington NASA Sep. 1973 10 p ref Transl. into ENGLISH from the book "Optika Okean i Atmosfery" Leningrad, Nauka Press, 1972 p 56-62

(Contract NASw-2483)

(NASA-TT-F-14777) Avail: NTIS HC $4.00 CSCL 20F

Intensity of radiation emerging from the medium limited by the glassy surface is determined by an integral equation. Functions, which are in this equation, depend on several arguments. By using the principle of reversibility for optical phenomena it is shown that the auxiliary functions can be determined from a different system of integral equations. Author

N74-20320*# Scripta Technica, Inc., Washington, D.C.

NONSTATIONARY RADIATION FIELD IN A SEMI-INFINITE MEDIUM WITH NONISOTROPIC SCATTERING

A. M. Gurfink NASA Oct. 1973 11 p refs Transl. into ENGLISH from the book "Optika Okeana i Atmosfery" Nauka Press, Leningrad, 1972 p 70-80
(Contract NASw-2484)
(NASA-TT-F-14780) Avail: NTIS HC $4.00 CSCL 20F

A solution of the nonstationary transport equation for the case of a semi-infinite anisotropic medium with a severely elongated scattering envelope is presented. Author

N74-20321*# Scientific Translation Service, Santa Barbara, Calif.
STUDY OF POLARIZATION OF LIGHT SCATTERED BY SEA WATER
S. Ye. Kondrashev Washington NASA Sep. 1973 18 p refs Transl. into ENGLISH from the publ. "Optika Okeana i Atmosfery" Leningrad, Nauka, 1972 p 136-148
(Contract NASw-2035)
(NASA-TT-F-14782) Avail: NTIS HC $4.00 CSCL 20F

The composition of suspended matter is analyzed in two sea water samples with close scattering coefficients. The analysis is based on the consideration of the polarization parameters of scattered light computed from the experimental determination of the scattering matrix. Author

N74-20322*# Space Optics Research Labs., Inc., Chelmsford, Mass.
LOW SCATTER LENS DESIGN/DEVELOPMENT
Robert B. Gallipeau and Anthony Quesada 1 Mar. 1974 116 p refs
(Contract NAS9-13561)
(NASA-CR-134224) Avail: NTIS HC $9.00 CSCL 20F

The criteria for the optimum design of optical systems are discussed along with the selection of appropriate materials. The construction details of low scatter lens systems are tabulated. Scattering analysis; total energy diffracted; and computation of delta for a scratch, bubble, and microscopic irregularities are also discussed. F.O.S.

N74-20323# Rochester Univ., N.Y. Dept. of Radiation Biology and Biophysics.
THERMAL EFFECTS OF SINGLE AND REPEATED EXPOSURES TO MICROWAVES
S. M. Michaelson 1973 68 p refs Presented at the Intern. Symp. on Biol. Effects and Health Hazards of Microwave Radiation, Warsaw, 15 Oct. 1973
(UR-3490-317; Conf-731042-1) Avail: NTIS HC $5.50

Thermal effects of single and repeated exposure to microwaves with respect to threshold phenomena and physiological adaptation are reported. Threshold response is noted in rabbits exposed to 2.45, 5.40, 8.23 and 10.05 GHz microwaves localized to the eye at power density/time durations sufficient to result in opacities. Adaptive reactions were noted in the dog, rabbit, and rat. For example, repeated whole-body exposure of dogs to 2.88 GHz and 1285 MHz pulsed microwaves at power densities from 20 to 165 mW/sq cm, 1 to 6 hours per day for 2 to 4 weeks showed thermal adaptation or acclimatization as reflected by diminished temperature response as the exposures continued. Rats repeatedly exposed to 2.45 GHz pulsed reveal adaptive reaction of functional changes. Acetylcholine levels in the blood of rabbits and functional changes such as arterial pressure alterations in rabbits also shows the phenomenon of adaptation as a result of repeated exposures to thermogenic levels of microwaves. The use of these studies as a means of examining some fundamental aspects of thermoregulation, acclimatization or adaptation, and interrelated cardiovascular, biochemical and neuroendocrine functions is suggested. Author

N74-20324# Frankford Arsenal, Philadelphia, Pa.
FORMING PRECISION OPTICS USING ION BEAM. IONIC FIGURING OF OPTICAL SURFACES Final Report
James D. Lester Aug. 1973 38 p refs
(DA Proj. 6726819)
(AD-772975; FA-R-2087) Avail: NTIS CSCL 20/6

A system which uses a beam of low energy positive ions to shape and polish surfaces of optical elements has been developed at Frankford Arsenal. This system is used to form ultra-high precision optical surfaces under the direction of an on-line computer. The resultant optical surface is both highly accurate and extremely smooth. The report presents the physical theory involved in low energy ionic sputtering, together with a description of the linear positive ion accelerator developed and used for this process. Experimental results are presented, including surface microstructure morology. Author (GRA)

N74-20325# Naval Research Lab., Washington, D.C.
ON THE THEORY OF TOTAL REFLECTION
F. I. Federov 7 Jan. 1974 10 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Dokl. (USSR), v. 105, no. 3, 1955 p 465-468
(AD-773381; NRL-Trans-1281) Avail: NTIS CSCL 20/6

Total reflection for random elliptical polarization of the incident wave is examined. E.H.W.

N74-20326# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
SCINTILLATION OF ARBITRARY OPTICAL BEAMS IN A WEAKLY RANDOM MEDIUM
Russell E. Warren Oct. 1973 47 p refs
(AF proj. 2001)
(AD-773799; AFAL-TR-73-372) Avail: NTIS CSCL 20/6

The study is concerned with deriving an expression for the scintillation of optical beams propagating through a weakly random medium for arbitrary transmitter wavefronts. The basis of the calculation is the extended Huygens-Fresnel principle of Lutomirski and Yura together with an expansion of the random component of the Green's function, the spherical distortion, to terms of second order in the refractive index fluctuation in a manner adapted from Schmeltzer. The scintillation formula is then applied to the simple analytic cases of plane wave, spherical wave, and collimated Gaussian beam wave scintillation by way of example, and the well-known results are obtained.
Author (GRA)

N74-20327# Towill, Inc., San Francisco, Calif.
AN EMPIRICAL STUDY OF LIGHT PATH BEHAVIOR, AND APPLICATION OF THE FINDINGS TO THE DESIGN OF PRECISE SURVEYING SYSTEMS FOR DAM ALIGNMENT Final Report
Vicksburg, Miss. Army Engr. Waterways Expt. Station Dec. 1973 67 p refs
(Contract DACW03-71-C-0068)
(AD-773654; AEWES-Misc-Paper-O-73-12) Avail: NTIS CSCL 08/2

Two locations were studied--one in California at the Stanford Linear Accelerator site and one at Table Rock Dam on the White River in Missouri--to gain an understanding of the forces and influences that act on a precise surveying system, to attempt to identify the cause of detrimental influences, and to investigate the feasibility of minimizing these influences in practical applications. Light path behavior was studied. The effects of temperature, pressure, humidity, wind, and fog on light paths were determined. The effects of elevation on survey lines, length of line, and laser output were also studied. (Modified author abstract) GRA

N74-20328# Manchester Univ. (England).
PROPAGATION OF HIGH ENERGY PULSES OF 10.6 MICROMETER RADIATION THROUGH THE ATMOSPHERE Final Technical Report
P. F. Browne, A. Chittenden, and C. Smalley Oct. 1973 33 p refs
(Contract DAJA37-73-C-0493)
(AD-773636) Avail: NTIS CSCL 20/6

The report contains a detailed theoretical discussion of the effect of CO2 laser (10.6 micrometer wavelength) energy on fog droplets, and the subsequent effects on the optical propagation path of the laser beam. Changes in refraction index in the beam cross section are considered. Plans for construction of a fog generation chamber for water fogs of controlled characteristics suitable for CO2 laser experimentation are given. Work on the development of CO2 TEA2 laser and triggering systems and progress on a 50 W CW diffusion cooled CO2 laser is discussed. Planned experiments, using the laser under development, for study of the interaction of such beams with laboratory controlled fogs are described. Author (GRA)

N74-20092 Itek Corp., Lexington, Mass.
LOW SCATTER FINISHING OF OPTICAL ELEMENTS
William Barnes *In* NBS Laser Induced Damage in Opt. Mater., 1973 Dec. 1973 p 64-68 refs (For availability see N74-20083 11-16)

N74-20094 Owens-Illinois Technical Center, Toledo, Ohio.
SOME ASPECTS OF SURFACE DAMAGE THAT CAN BE EXPLAINED WITH LINEAR OPTICS
M. D. Crisp *In* NBS Laser Induced Damage in Opt. Mater., 1973 Dec. 1973 p 80-83 refs (For availability see N74-20083 11-16)

N74-20109 Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass. Solid State Sciences Lab.
PHOTOELASTIC CONSTANTS OF INFRARED TRANSMITTING MATERIALS
Bernard Bendow and Peter D. Gianino *In* NBS Laser Induced Damage in Opt. Mater., 1973 Dec. 1973 p 194-201 refs (For availability see N74-20083 11-16)

N74-20110 University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
CHECKS OF MULTI-PHONON ABSORPTION THEORY
Robert Hellwarth *In* NBS Laser Induced Damage in Opt. Mater., 1973 Dec. 1973 p 202-207 refs (For availability see N74-20083 11-16)
(Contract F19628-72-C-0275)

N74-20111 Xonics, Inc., Van Nuys, Calif.
THEORY OF MATERIAL FAILURE IN CRYSTALS CONTAINING INFRARED ABSORBING INCLUSIONS
C. J. Duthler and M. Sparks *In* NBS Laser Induced Damage in Opt. Mater., 1973 Dec. 1973 p 208-216 refs (For availability see N74-20083 11-16)
(Contract DAHC15-73-C-0127)

N74-20113 Harvard Univ., Cambridge, Mass.
STUDIES OF INTRINSIC OPTICAL BREAKDOWN
David W. Fradin and Michael Bass (Raytheon Co., Waltham, Mass.) *In* NBS Laser Induced Damage in Opt. Mater., 1973 Dec. 1973 p 225-238 refs (For availability see N74-20083 11-16)
(Contracts N00014-67-A-0298-0006; F19268-70-C-0223; F19628-73-C-0127)

N74-20115 Naval Electronics Lab. Center, San Diego, Calif.
SPECTRAL EMITTANCE MEASUREMENTS ON SEVERAL CRYSTALLINE SAMPLES
D. L. Stierwalt *In* NBS Laser Induced Damage in Opt. Mater., 1973 Dec. 1973 p 250-253 ref (For availability see N74-20083 11-16)

N74-20357 Nagoya Univ. (Japan). Inst. of Plasma Physics.
MEASUREMENT OF THE ABSOLUTE INTENSITY OF RADIATION IN THE SOFT X-RAY AND EXTREME ULTRAVIOLET REGION
H. Sugawara, T. Sasaki, and T. Oda *In its* The Record of Symp. on Plasma Diagnostics Dec. 1973 p 48-61 refs (For availability see N74-20350 11-25)

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N74-20329* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RADIATION HARDENING OF MOS DEVICES BY BORON Patent
Vitaly Danchenko, inventor (to NASA) Issued 26 Mar. 1974 4 p Filed 9 Dec. 1971 Supersedes N72-20637 (10 - 11, p 1503)
(NASA-Case-GSC-11425-1; US-Patent-3,799,813; US-Patent-Appl-SN-206266; US-Patent-Class-148-1.5) Avail: US Patent Office CSCL 18F

A technique is described for radiation hardening of MOS devices and specifically for stabilizing the gate threshold potential at room temperature of a radiation subjected MOS field-effect device with a semiconductor substrate, an insulating layer of oxide on the substrate, and a gate electrode disposed on the insulating layer. The boron is introduced within a layer of the oxide of about 100 A-300 A thickness immediately adjacent the semiconductor-insulator interface. The concentration of boron in the oxide layer is preferably maintained on the order of 10 to the 18th power atoms/cu cm. The technique serves to reduce and substantially annihilate radiation induced positive gate charge accumulations. Official Gazette of the U.S. Patent Office

N74-20330 Michigan Univ., Ann Arbor.
LASER INDUCED ELECTRON EMISSION Ph.D. Thesis
James Harvey Bechtel 1973 115 p
Avail: Univ. Microfilms Order No. 74-3578

Laser induced electron emission from tungsten, molybdenum, and platnium were observed using Q-switched ruby lasers. Experimental results from tungsten indicated that processes other than thermionic emission occur at irradiances of tens of megawatts per square centimeter and pulse durations of tens of nanoseconds. For these laser irradiances and pulse durations the emitted electron pulses had maximum currents in the range of .1 to 100 milliamperes, and this maximum current was delayed approximately 5 nanoseconds with respect to the maximum incident laser irradiance. This measured time delay is consistent with a thermal origin for the electron emission process; however, the relation between the emitted current and the incident laser irradiance was substantially less nonlinear than that predicted by the Richardson-Dushman equation. Dissert. Abstr.

N74-20331 Pennsylvania Univ., Philadelphia.
GEOPHYSICAL IMPLICATIONS OF RADIOCARBON MEASUREMENTS Ph.D. Thesis
Elizabeth Kennedy Ralph 1973 67 p
Avail: Univ. Microfilms Order No. 74-2449

The principle and basic assumptions for the existence of natural C-14, and its usefulness for dating are described. However, it is now known that the atmospheric inventory of C-14, has not been constant over the past 7000 years, as originally assumed. Determinations by C-14 dating of tree-ring-dated sequoias and bristlecone pines have pointed out inconsistencies (oscillations) in the inventory. There is a long-term trend with a period of about 9000 years during which C-14 dates become increasingly too young in the B.C. millennia and reach a peak discrepancy of at least 700 years from about 4100 B.C. to 5000 B.C. in terms of calendric years. Superimposed upon this long-term deviation there are shorter-term oscillations with much smaller magnitudes in both directions. Possible reasons for the long-term trend and the smaller oscillations of shorter duration are discussed. Dissert. Abstr.

N74-20332*# Nebraska Univ., Lincoln. Behlen Lab. of Physics.
PARTIALLY AUTOIONIZING STATES OF ATOMIC OXYGEN
James A. R. Samson and V. E. Petrosky [1972] 11 p refs (Grant NGR-28-008-021)
(NASA-CR-137360) Avail: NTIS HC $4.00 CSCL 07D

The Rydberg states 3d' (3Po)2,1,0 and 3s'' (3Po)2,1,0 and the inner shell transition 2s 2p5 (3Po)2,1,0, which are forbidden to autoionize on the basis of LS coupling, were observed in emission spectroscopy and in autoionization spectra produced in the photoelectron spectrum of atomic oxygen. Author

N74-20333*# Nebraska Univ., Lincoln. Behlen Lab. of Physics.
PHOTOELECTRON ANGULAR DISTRIBUTIONS AS A PROBE OF ANISOTROPIC ELECTRON-ION INTERACTIONS
Dan Dill (Boston Univ., Mass.) and Steven T. Manson (Ga. State Univ.,) [1973] 13 p refs
(Grants NGR-28-004-021; NSF GP-38905)
(NASA-CR-138027; COO-1674-88) Avail: NTIS HC $4.00

CSCL 20H

Expressions are given for atomic photoelectron angular distributions in LS coupling in which the role of anisotropic final state electron-ion interactions emerges explicitly. Calculations of photoelectron angular distributions for atomic sulfur are presented in which these anisotropic interactions produce pronounced deviations from the predictions of the Cooper-Zare model. Such effects are expected to be a general feature of photoelectron angular distributions for most open-shell atoms. Author

N74-20334*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.

ROTATIONAL AND VIBRATIONAL SPECTRA OF MOLECULAR IONS: FEASIBILITY OF LABORATORY AND ASTROPHYSICAL OBSERVATION

R. C. Woods, P. R. Certain, and R. B. Bernstein 14 Jan. 1974 60 p refs

(Grants NGL-50-002-001; NSF GP-35848X; NSF GP-28213) (NASA-CR-137454; WIS-TCI-503) Avail: NTIS HC $6.00 CSCL 20H

The rotational spectra of a number of small molecular ions should be detectable in the microwave or millimeter wave regions in laboratory experiments using currently available techniques. The dipole moments and absorption coefficients of polar diatomics CO(+) and NO(+) as well as asymmetric isotopically enriched species, like O-18O-16(+), NE-20NE-22(+), and OC-18 O-16(+) are calculated to be sufficiently large to allow observation of their spectra. In addition to the detailed molecular structure information which such spectral data would provide, precise knowledge of the transition frequencies would render likely the detection of certain of these ions in the interstellar sources or in planetary atmospheres. All of these ions also possess vibrational spectra which should be detectable in the infrared region in laboratory or astrophysical sources. Author

N74-20335*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

TRACE-ELEMENT ANALYSIS OF 1000 ENVIRONMENTAL SAMPLES PER YEAR USING INSTRUMENTAL NEUTRON ACTIVATION ANALYSIS

Dean W. Sheibley Mar. 1974 25 p refs

(NASA-TM-X-71519; E-7724) Avail: NTIS HC $4.25 CSCL 18H

The technology and methods developed at the Plum Brook Reactor to analyze 1000 samples per year and report data on as many as 56 elements are described. The manpower for the complete analysis of 20 to 24 samples per week required only 3 to 3.5 hours per sample. The solutions to problems encountered in sample preparation, irradiation, and counting are discussed. The automation of data reduction is described. Typical data on various sample matrices are presented. Author

N74-20336# Nagoya Univ. (Japan). Inst. of Plasma Physics.

COAXIAL MARX GENERATOR FOR PRODUCING INTENSE RELATIVISTIC ELECTRON BEAMS

Y. Kubota, S. Kawasaki, A. Miyahara, and H. M. M. Saad Sep. 1973 17 p refs

(IPPJ-T-15) Avail: NTIS HC $4.00

A 600 kV Marx generator installed in a completely coaxial form is developed. The structure reduces the internal inductance down to about 80 nH and hence makes it possible to produce high intensity relativistic electron beams of several ka when applied to a field emission type electron gun. The system has a remarkably compact size of the full length 1400 mm and the diameter 250 mm. The rise time of the output voltage pulse is less than 10 nsec. Author

N74-20337*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

FESHBACH RESONANCES IN POSITRON-HYDROGEN SCATTERING

Richard J. Drachman Mar. 1974 32 p refs Submitted for publication

(NASA-TM-X-70617; X-602-74-77) Avail: NTIS HC $4.75 CSCL 20H

Using a wave function including the 1s-2s-2p eigenstates of hydrogen and the 1s ground state of positronium, we have calculated the position and width of the lowest Feshbach resonance in the e(+)-H system, which lies between the positronium rearrangement threshold and the n=2 hydrogen threshold. The method differs from the usual close-coupling method, resembling in its formulation the projection operator technique, although orthogonality of closed-channel and open-channel functions is not demanded. The resonance lies 9.8281 eV above the ground state of hydrogen and has width of 0.029 eV in this approximation. Author

N74-20338# Istituto Superiore di Sanita, Rome (Italy). Lab. di Fisica.

STUDY OF TOTAL ABSORPTION COUNTERS FOR VERY HIGH ENERGY PARTICLES

A. Baroncelli 15 Sep. 1973 32 p refs

(ISS-P-73/8) Avail: NTIS HC $4.75 CSCL 20H

The development of the nuclear-electromagnetic cascade initiated by a strongly interacting particle was studied by means of the Monte Carlo method. The model used to simulate the cascade and the performances of a total absorption counter of the sample type, which consist of a sandwich of absorbers and scintillator plates are discussed. The resolution is studied as a function of the geometry and of the incident particle energy in the range 5-300 GeV. The results of the calculation show that at 300 GeV an energy resolution of about + or - 4% can be achieved. Author

N74-20339# Interuniversitair Reactor Instituut, Delft (Netherlands).

TRENDS IN THE USE OF NUCLEAR RADIATION IN SCIENCE Progress Report, 1963 - 1973

Sep. 1973 50 p refs Proc. of the Interuniversitair Reactor Inst. Meeting, Delft, Neth., 15 Jun. 1973

Avail: NTIS HC $5.50

A review of the activities of the Interuniversitair Reactor Instituut is presented. The use of nuclear radiation is discussed with regard to neutron scattering, neutron depolarization, neutron capture rates, Doppler effect, radiation damage, Mossbauer effect, dosimeters, radioisotope tracers, and chemical effects of irradiation. Neutron scattering techniques are detailed in regard to various fields of application among which are: (1) biological system structure determination by neutron diffraction; (2) magnetization around impurities by polarized neutron techniques; (3) phonon dispersion curved in various materials by inelastic neutron scattering; (4) and self diffusion coefficient determination by quasi elastic scattering. The interaction between research and technology is stressed in two specific examples related to radioactive tracers and activation analyses. For individual titles, see N74-20340 through N74-20342.

N74-20340 Interuniversitair Reactor Instituut, Delft (Netherlands).

THE USE OF NUCLEAR RADIATION IN THE INTERUNIVERSITAIR REACTOR INSTITUUT 1963-1973

J. J. VanLoef *In its* Trends in the Use of Nucl. Radiation in Sci. Sep. 1973 p 6-26 refs (For availability see N74-20339 11-24)

The activities of the I.R.I. in various fields are reviewed with regard to neutron scattering, neutron depolarization, activation analysis, neutron capture rates, Doppler effect, neutron and gamma ray transport, radiation damage, Mossbauer effect, dosimetry radioisotope tracers, and chemical effects of irradiation. Specific applications are detailed in the fields of radiochemistry, health physics, reactor physics and molecular physics. ESRO

N74-20341 Institut Max von Laue/Paul Langevin, Grenoble (France).

NEUTRON SCATTERING TECHNIQUES

B. Jacrot *In* Interuniversitair Reactor Inst. Trends in the Use of Nucl. Radiation in Sci. Sep. 1973 p 27-38 refs (For availability see N74-20339 11-24)

A review of neutron scattering techniques is presented. The fundamental experiments of neutron physics are summarized and indications of trends in neutron sources are given. Associated diagnostic instruments are outlined. Various fields of research are discussed with regard to neutron diffraction as applied to biological structure determination. Magnetization around impurities are dealt with in relation to polarized neutron techniques. Neutron inelastic scattering is discussed with regard to phonon

dispersion curves in various materials including polymers. The importance of quasi-elastic neutron scattering for self diffusion coefficient determination is emphasized, and possible applications are outlined. Neutron infrared spectroscopy as applied to chemistry is surveyed. ESRO

N74-20342 Western Regional Hospital Board, Glasgow (Scotland). Dept. of Clinical Physics and Bio-Engineering.
THE RESEARCH REACTOR AS A WINDOW ON THE WORLD
J. M. A. Lenihan *In* the Use of Nucl. Radiation in Sci. Sep. 1973 p 39-48 (For availability see N74-20339 11-24)

The interdependence of research and technology is stressed in two specific examples. The first is radioactive tracers as applied to biological systems, dilution studies, and time distribution. The second example deals with activation analysis as applied to health physics, probing of the chemical composition of man, and age determination of fossils. ESRO

N74-20343# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
AUTOMATION OF MEASUREMENTS CONCERNING METASTABLE PARTICLES USING A SMALL COMPUTER
M. Ahrweiller, M. Fajoles, J. P. Felix, A. Hourdin, and H. Jeudon 22 Dec. 1972 8 p In FRENCH Presented at Mesucora 73 and 64 Phys. Exhibition Meeting, Paris, 11-18 Apr. 1973
(CEA-CONF-2348; Conf-730459-3) Avail: AEC Depository Libraries HC $3.00

In the first experiment, which involves collisions between a beam of metastable helium and neutral inert gas particles, the effective ionization cross section was measured using a mass spectrometer. The electron spectrum was also determined. The computer is used in conjunction with weighted time-of-flight measurements and enables a reliable, multichannel and entirely electronic system to be employed. In the second experiment, collisions involving the inelastic exchange of an electron between a proton beam and a jet of neutral alkali atoms were studied. The fine structure observations necessitate a high angular resolution in view of the very small particle flux measured. The counting of the very low pulse arrival rates, which are partially obscured by background noise, requires a method in which parasites are eliminated. NSA

N74-20344# Air Force Academy, Colo. Frank J. Seiler Research Lab.
CALCULATION OF MORSE WAVE FUNCTIONS WITH PROGRAMMABLE DESKTOP CALCULATORS
G. Diana Brabson Nov. 1973 99 p refs
(AF Proj. 7903)
(AD-772657; SRL-TR-73-0015) Avail: NTIS CSCL 07/4

It is very helpful for the student of electronic transitions in diatomic molecules to be able to visualize vibrational wave functions, probability distributions and the overlap of wave functions. As the result of recent advances in programmable calculator technology, it is now possible to calculate and plot these mathematical functions for the Morse potential using a programmable desktop calculator. This report includes (1) a reprint of the journal article which describes techniques for calculating the Morse wave functions, (2) a single precision Morse potential program for the Wang 700B calculator, (3) a double precision Morse potential program for the Wang 720B calculator, and (4) a double precision Morse potential program for the Burroughs B6700 computer. Each program is completely documented. Typical results are included to illustrate the proper operation of each program. (Modified author abstract) GRA

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N74-20345 Tennessee Univ., Knoxville.
COMPUTER CONTROLLED FEEDBACK STABILIZATION OF AN MHD PLASMA INSTABILITY Ph.D. Thesis
Gerald Ulrich Merckel 1973 164 p
Avail: Univ. Microfilms Order No. 74-3851

The feasibility is considered of employing a sensor based computer control system for the suppression of a plasma magnetohydrodynamic (MHD) instability and to characterize the performance requirements of such a computer control system. A general MHD plasma model is utilized to describe the spatial-time dependent behavior of a plasma surface perturbation. The computer control system introduces feedback effects through the activation of azimuthal currents causing additional transverse magnetic fields which act to restore the plasma deformation. An energy density imbalance condition based upon the theme of a Z-Theta plasma pinch is developed to characterize this phase of the transient. Consideration is given to the temporal properties of the computer control system, the resident control algorithm, and the time delays associated with the control magnetic fields. Dissert. Abstr.

N74-20346 Michigan Univ., Ann Arbor.
LIGHT SCATTERING IN COLLISIONAL PLASMAS Ph.D. Thesis
Ellen Marie Leonard 1973 77 p
Avail: Univ. Microfilms Order No. 74-3669

The scattering of electromagnetic radiation by a fully ionized, collision dominated plasma in a magnetic field is investigated using a stochastic approach. The stochastic equations for the density fluctuation operators are modified to include like particle collisions through a BGK collision model. The equations of this model are constructed to conserve particle number, energy and momentum. Explicit numerical results are obtained in the absence of magnetic fields and compared to experiments and other theories. The analytical results are assumed valid for plasmas which can be characterized by Maxwellian velocity distributions for electrons and ions at the same or different temperatures. Dissert. Abstr.

N74-20347 Rensselaer Polytechnic Inst., Troy, N.Y.
AN ION BEAM PROBE DIAGNOSTIC SYSTEM FOR LABORATORY PLASMA Ph.D. Thesis
Robert E. Reinovsky 1973 291 p
Avail: Univ. Microfilms Order No. 74-5154

Ion beam probing has been shown to be a general purpose diagnostic tool for magnetically confined plasmas. A complete system was designed, constructed and operated on a number of laboratory plasmas to demonstrate the applicability of beam probing to laboratory devices. The results demonstrate that the advantages of ion beam probing can be achieved with modest expenditure of time and resources. The various components of a complete beam probe system were investigated theoretically and experimentally for the first time. The results show that the beam probe system is dominated by electron impact ionization, as expected, that simple detectors have several limitations, and that the feedback controlled electrostatic energy analyzer demonstrates the spatial and time resolution expected from the theoretical analysis. Dissert. Abstr.

N74-20348*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
PARTITION FUNCTION FOR A TWO DIMENSIONAL PLASMA IN THE RANDOM PHASE APPROXIMATION
C. E. Seyler, Jr. Jan. 1974 9 p refs
(Grant NGL-16-001-043)
(NASA-CR-138004; U-of-Iowa-74-6) Avail: NTIS HC $4.00 CSCL 20I

The partition function for a two-dimensional plasma is evaluated within the random phase approximation. The periodic boundary conditions are fully taken into account by including the periodic image interactions. In the guiding-center limit, the negative temperature threshold energy is evaluated, and a value different from previous calculations results. When an identical random phase evaluated, and a value different from previous calculations results. When an identical random phase evaluation is applied to the finite gyroradius plasma, the Salzberg-Prager-May equation of state is recovered. Author

N74-20349*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
THERMAL RELAXATION OF A TWO DIMENSIONAL PLASMA IN A dc MAGNETIC FIELD. PART 2: NUMERICAL SIMULATION
J. -Y. Hsu, Glenn Joyce, and David Montgomery Jan. 1974

15 p refs
(Grants NGL-16-001-043; AT(11-1)-2059)
(NASA-CR-138003; U-of-Iowa-74-2-Pt-2) Avail: NTIS HC $4.00 CSCL 20I

The thermal relaxation process for a spatially uniform two dimensional plasma in a uniform dc magnetic field is simulated numerically. Thermal relaxation times are defined in terms of the time necessary for the numerically computer Boltzman H-function to decrease through a given part of the distance to its minimum value. Dependence of relaxation time on two parameters is studied: number of particles per Debye square and ratio of gyrofrequency to plasma frequency. Author

N74-20350# Nagoya Univ. (Japan). Inst. of Plasma Physics.
THE RECORD OF SYMPOSIUM ON PLASMA DIAGNOSTICS
Dec. 1973 82 p refs Symp. held at Nagoya, Japan, 21 Feb. 1973
(IPPJ-181) Avail: NTIS HC $7.25

Summaries are given of various methods and instruments used to study plasma diagnostics. For individual titles, see N74-20351 through N74-20359.

N74-20351 Nagoya Univ. (Japan). Electrotechnical Lab.
DESIGN OF SIN-COS-PROBE FOR ETL-TPE-1 **c14**
Eiichi Yahagi *In its* The Record of Symp. on Plasma Diagnostics Dec. 1973 p 1-8 (For availability see N74-20350 11-25)

Design details are given of a sin-cos-probe for a toroidal machine. The probe consists of three coils each of which is wound around an identical toroidal spool. An attempt was made to design the probe to withstand voltages greater than 30 kV, have a cos-coil signal greater than 0.5 mV, have frequency characteristics wider than from 1 KHz to 15 MHz, and have signals observable within an error of 1% up to a time corresponding to the time constant crowbar, that is 150 microsec. E.H.W.

N74-20352 Nagoya Univ. (Japan). Inst. of Plasma Physics.
LOW FREQUENCY OSCILLATION IN A HIGH DENSITY PLASMA
Yasushi Nishida (Tohoku Univ., Sendai) and Kazushige Ishii *In its* The Record of Symp. on Plasma Diagnostics Dec. 1973 p 9-12 refs (For availability see N74-20350 11-25)

Investigations are reported on the Alfven wave instability in an arc discharge which has a parallel current along the magnetic field. When the plasma density becomes high, the collisions between the charged particles are strong and the collisional effects must be taken into account. Experimental results and their interpretation in a diffused high density plasma without the parallel current are reported. It was shown that the coupled mode of the collisional Alfven wave and the collisional drift wave can exist. Author

N74-20353 Nagoya Univ. (Japan). Faculty of Engineering.
DISTRIBUTION MEASUREMENT IN WAVE VECTOR-SPACE OF ION ACOUSTIC WAVE BY MICROWAVE SCATTERING
Atsushi Mase, Takumi Yamamoto, and Takashige Tsukishima *In its* The Record of Symp. on Plasma Diagnostics Dec. 1973 p 13-22 refs (For availability see N74-20350 11-25)

A report is given on the experimental results of microwave scattering from an ion acoustic wave excited externally in a mercury positive column, with emphasis on the measurement of the intensity distribution of the ion acoustic wave in the wave vector space. The ion acoustic wave is excited via the asterisk grid, to which an ac signal from an oscillator is applied. Author

N74-20354 Tokyo Univ. (Japan). Dept. of Nuclear Engineering.
REVIEW OF PARTICLE DIAGNOSTICS
N. Inoue *In* Nagoya Univ. The Record of Symp. on Plasma Diagnostics Dec. 1973 p 23-29 refs (For availability see N74-20350 11-25)

A variety of corpuscular measurements were developed for the diagnostics of hot plasmas. The particle measurements can be divided into two categories: mass and energy analysis of particles emitted from plasmas and methods of beam probing. In the latter case one injects particle beams into the plasma and observe the interaction between the beam particles and the plasma particles. Particle measurements which are applicable to the closed magnetic confinement system are examined. Author

N74-20355 Hiroshima Univ. (Japan). Dept. of Physics.
SPECTRAL LINE PROFILE AND ITS APPLICATION TO PLASMA DIAGNOSTICS
Toshiatsu Oda *In* Nagoya Univ. The Record of Symp. on Plasma Diagnostics Dec. 1973 p 31-41 refs (For availability see N74-20350 11-25)

Spectral line profiles and broadening of those profiles by Doppler and/or Stark effect are examined. Plasma spectroscopy is also discussed. Author

N74-20356 Osaka Univ. (Japan). Faculty of Engineering.
AN ATTEMPT TO DETERMINE ELECTRON TEMPERATURE BY THE MEASUREMENT OF LYMAN STEP OF HELIUM ION CONTINUUM
S. Ohsumi and T. Ishimura *In* Nagoya Univ. The Record of Symp. on Plasma Diagnostics Dec. 1973 p 42-47 refs (For availability see N74-20350 11-25)

An experimental study was made of a method used to determine the electron temperature of a high temperature plasma. The method invoives the measurement of spectral emissivity of free-free and free-bound radiation. Author

N74-20357 Nagoya Univ. (Japan). Inst. of Plasma Physics.
MEASUREMENT OF THE ABSOLUTE INTENSITY OF RADIATION IN THE SOFT X-RAY AND EXTREME ULTRAVIOLET REGION **c23**
H. Sugawara, T. Sasaki, and T. Oda *In its* The Record of Symp. on Plasma Diagnostics Dec. 1973 p 48-61 refs (For availability see N74-20350 11-25)

A hetrochromatic calibration technique for measuring radiation intensity in the soft X-ray and extreme ultraviolet regions is introduced. For the measurement of absolute intensity in the extreme ultraviolet region, a method utilizing the energy analysis of photoelectrons is proposed. E.H.W.

N74-20358 Nagoya Univ. (Japan). Inst. of Plasma Physics.
LASER LIGHT SCATTERING FROM A TURBULENTLY HEATED PLASMA **c16**
K. Kondo *In its* The Record of Symp. on Plasma Diagnostics Dec. 1973 p 62-69 (For availability see N74-20350 11-25)

The use of laser light scattering to determine electron velocity with high spatial and temporal distribution in a turbulently heated plasma is studied. Author

N74-20359 Nagoya Univ. (Japan). Dept. of Electronics.
RELATIVISTIC CORRECTIONS TO THE SPECTRUM OF SCATTERED LIGHT FROM A HIGH TEMPERATURE PLASMA **c16**
Kiyoshi Hayase and Takayoshi Okuda *In its* The Record of Symp. on Plasma Diagnostics Dec. 1973 p 70-75 refs (For availability see N74-20350 11-25)

The modification of the scattering cross section in a high energy region and its effect on temperature estimation is considered. Author

N74-20360*# Stanford Univ., Calif. Inst. for Plasma Research.
COMPUTATIONAL STUDY OF NONLINEAR PLASMA WAVES
Y. Matsuda Mar. 1974 174 p refs
(Grants NGL-05-020-176; NSF GK-32788X)
(NASA-CR-137375; SU-IPR-567) Avail: NTIS HC $11.75 CSCL 20I

A low-noise plasma simulation model is developed and applied to a series of linear and nonlinear problems associated with electrostatic wave propagation in a one-dimensional, collisionless, Maxwellian plasma, in the absence of magnetic field. It is demonstrated that use of the hybrid simulation model allows economical studies to be carried out in both the linear and nonlinear regimes with better quantitative results, for comparable computing time, than can be obtained by conventional particle simulation models, or direct solution of the Vlasov equation. The characteristics of the hybrid simulation model itself are first investigated, and it is shown to be capable of verifying the theoretical linear dispersion relation at wave energy levels as

low as .000001 of the plasma thermal energy. Having established the validity of the hybrid simulation model, it is then used to study the nonlinear dynamics of monochromatic wave, sideband instability due to trapped particles, and satellite growth. Author

N74-20361# Nagoya Univ. (Japan). Inst. of Plasma Physics.
HYDROGEN OCCLUSION OF TITANIUM WASHERS FOR THE TITANIUM PLASMA SOURCE
Y. Nakagawa Jan. 1974 11 p refs
(IPPJ-T-19) Avail: NTIS HC $4.00

A procedure is introduced for obtaining titanium washers that absorb the greatest amount of hydrogen from titanium plasma sources. In an electric furnace at some time after the beginning of the temperature rise of titanium by reaction heat, titanium washers are quickly cooled by dragging them from the high temperature to the room temperature part of the electric furnace. By this procedure the amount of hydrogen absorbed by a titanium washer can be controlled and the most desirable titanium washer for a titanium plasma source can be obtained. Author

N74-20362# Nagoya Univ. (Japan). Inst. of Plasma Physics.
DIRECT DIGITAL CONTROL OF A PLASMA
Atsushi Ogata and Kiyokata Matsuura Jan. 1974 60 p refs
(IPPJ-T-18) Avail: NTIS HC $6.00

A direct digital control, where a digital computer is utilized as a feedback element, is applied to stabilize a cusp position of a stationary plasma. The direct digital control is inferior to the conventional analog control in speed, but features in finite settling time and great flexibility. Author

N74-20363# Nagoya Univ. (Japan). Inst. of Plasma Physics.
NEW METHOD FOR ION SPECIFICATION IN A STEADY STATE MAGNETIZED PLASMA
Hussein M. Saad Sep. 1973 17 p refs
(IPPJ-T-14) Avail: NTIS HC $4.00

The H1(+) and H2(+) inside the bulk of a steady state magnetized plasma can be quantitatively measured without serious change in the plasma condition. An instantaneous axial gradient magnetic field is applied at the region under study along the axis. The particles are then accelerated towards the detecting system of the electrostatic analyzer which they reach at different times since they have the same energy but different masses. Both the detector and the accelerator, producing the axial gradient magnetic field, are placed outside the plasma volume, therefore a minimal and limited perturbing effect is introduced. Author

N74-20364# European Organization for Nuclear Research, Geneva (Switzerland).
THEORY OF IONIZATION GROWTH IN GASES UNDER PULSED AND STATIC FIELDS
A. J. Davies and C. J. Evans 10 Sep. 1973 122 p refs
(CERN-73-10) Avail: AEC Depository Libraries HC $8.25

The statistical and nonstatistical theory of ionization growth in gases under pulsed and static fields is described. The five chapters deal with: basic ionization and transport processes; nonstatistical uniform field theory; temporal growth of ionization in fields distorted by space charge; statistical theory; and applications. Author (NSA)

N74-20365# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Dept. de Physique du Plasma et de la Fusion Controlee.
STRUCTURE OF THE WAVE FIELD NEAR THE HYBRID FREQUENCIES AND APPLICATION TO INCOHERENT SCATTERING
M. Fichet, I. Fidone, and G. Granata [1973] 4 p refs Presented at the Intern. Conf. on Phenomena Ion Ionized Gases, Prague, 10-14 Sep. 1973
(CEA-Conf-2383) Avail: ' AEC Depository Libraries HC $3.00

A plasma slab with a smooth density gradient along x, normal to the faces and to the external magnetic field directed along z, is considered. The special case is considered so that there is no coupling between the two electromagnetic modes in the plasma. The electromagnetic field in the resonance region was also studied. NSA

N74-20366# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Dept. de Physique du Plasma et de la Fusion Controlee.
MEASUREMENTS OF THE LINEAR AND NONLINEAR STAGE OF THE BEAM-PLASMA INSTABILITY
R. Aymar, H. Boehmer, and F. Koechlin [1973] 4 p refs Presented at the 6th European Conf. on Controlled Fusion and Plasma Phys., Moscow, 30 Jul.-3 Aug. 1973
(CEA-Conf-2398; Conf-730705-14) Avail: AEC Depository Libraries HC $3.00

An electron beam is injected into the afterglow plasma of a pulsed P. I. G. discharge immersed in a uniform magnetic field of 2800 G. The plasma diameter is 5 cm; the length is variable from 150 to 230 cm. Therefore, the ratio of electron collision to plasma frequency is .001 so that collisions can be neglected in the dispersion relation for the hydrodynamic beam-plasma instability. The radial electron density profile, also measured by a Langmuir probe, is used to calculate the plasma branch of the dispersion relation. The electron beam energy is 6.5 keV, with an initially narrow energy distribution; its diameter is 0.8 and the pulse duration is 15 microsec. Author (NSA)

N74-20367# Technische Univ., Berlin (West Germany).
SPECIAL RESEARCH GROUP FOR MAGNETOHYDRODYNAMICS Progress Report, 1970 - 1972
Dec. 1972 97 p refs In GERMAN
(SFB-MHD-1) Avail: AEC Depository Libraries HC $7.00

The special research group for magnetohydrodynamics centralizes the entire West German research efforts in this particular field. The organization, funding, and first two years of operation are described. A brief survey is given of the ongoing work in Russia, U.S.A. and France. At Berlin, specialized groups study MHD from the standpoint of liquid metals, energy conversion systems, two-phase dynamics, heat sources, alkali metal technology, and measuring techniques. NSA

N74-20368# Los Alamos Scientific Lab., N.Mex.
JOULE LOSSES IN LINEAR THETA PINCHES: LASER VS MAGNETIC HEATING
W. R. Ellis 1973 9 p refs
(Contract W-7405-eng-36)
(LA-UR-73-1580; Conf-731114-1) Avail: NTIS HC $3.00

The dc joule losses per unit length in a theta pinch compression coil are calculated and compared to the thermonuclear energy production for two different methods of plasma heating. In the first method, conventional staged theta pinch heating is assumed. In the second method, laser heating by long wavelength irradiation from the ends is assumed. Reactor parameters are calculated, and it is shown that for circulating power fractions to be 20% or less, the plasma radius must be at least a few cm in size. Author (NSA)

N74-20369# Ecole Polytechnique Federale de Lausanne (Switzerland). Centre de Recherches en Physique des Plasmas.
LASER SCATTERING MEASUREMENTS ON A ROTATING MAGNETIC FIELD PINCH
Z. A. Pietrzyk, A. Heym, F. Hofmann, A. Lietti, P. Boulanger, and D. W. Ignat Aug. 1973 12 p refs
(LRP-65/73) Avail: NTIS HC $4.00

Laser light scattering measurements were made on a plasma subjected to a rotating magnetic field. The electron temperature and density were measured in the center of the discharge as a function of time. The results were compared with those of an MHD model. ESRO

N74-20370# Princeton Univ., N.J. Plasma Physics Lab.
ION ACOUSTIC PARAMETRIC DECAY INSTABILITIES WITH STRONG ION LANDAU DAMPING Technical Report, 20 Feb. - 1 Oct. 1973
J. T. Flick and H. W. Hendel 1 Oct. 1973 37 p refs
(Contract F30602-73-C-0163; ARPA Order 1423)
(AD-773852; RADC-TR-73-366) Avail: NTIS CSCL 20/9

Collective plasma phenomena similar to those occurring in the ionosphere upon incidence of intense electromagnetic waves have been studied in laboratory Q-machine plasmas. In particular, the ion acoustic parametric decay instability, of special interest with regard to the ionosphere, has been studied since it causes

strongly enhanced absorption of electromagnetic waves. (Modified author abstract) GRA

N74-20371# Polytechnic Inst. of Brooklyn, N.Y.
RESEARCH OF AEROPHYSICS INSTITUTE FOR STRATEGIC TECHNOLOGY Semiannual Technical Summary, period ending 31 Aug. 1973
Martin H. Bloom 31 Aug. 1973 21 p refs
(Contract DAHC04-69-C-0077; ARPA Order 1442)
(AD-773601; PIBAL-73-B; AROD-8677-41-P) Avail: NTIS CSCL 20/9

The report contains a description of the technical problem areas and accomplishments achieved during the reporting period. The research projects are in the general subject areas of fluid dynamics, flow diagnostics, and laser development. (Modified author abstract) GRA

N74-20372# Air Force Weapons Lab., Kirtland AFB, N.Mex.
CALORIMETER FOR SOFT X-RAY PLASMA SOURCES Technical Report, Sep. 1971 - Mar. 1972
Erskine J. T. Burns Jan. 1974 21 p refs
(AF Proj. 8809)
(AD-773765; AFWL-TR-73-192) Avail: NTIS CSCL 20/9

A calorimeter for soft X-ray plasma sources is discussed in theory, design, and operation. The receivers are metallic and are limited to radiation above 60 eV in a windowless mode. The absorbed radiant energy is transferred by means of a bimetallic thermocouple junction, which in turn is analyzed on a standard microvoltmeter. Author (GRA)

N74-20373# Catholic Univ. of America, Washington, D.C.
FUSION PLASMA CONVERSION Summary Progress Report, 1 Apr. 1972 - 31 Mar. 1973
Clyde L. Cowan 31 Mar. 1973 11 p
(Contract N00014-67-A-0377-0015; NR Proj. 099-401)
(AD-773937) Avail: NTIS CSCL 20/9

The ultimate objective of the research effort being carried on around the world is the achievement of a useful level of power output from a thermonuclear plasma. A new scheme for a fusion device was designed. This design, beginning with the simple desire to eliminate the need for coping with plasma instabilities in an essentially static, hot compressed plasma, led to the concept of dynamic containment. In this scheme, the plasma is contained in a continuously maintained magnetic field generated by three alternating fields. Heating is accomplished through a series of successive shocks combined with ohmic heating by plasma currents. Such a cyclic device would be continuously running, meeting the Lawson criterion over a number of cycles, on the average. GRA

N74-20374# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
STABILIZATION AND CONTROL OF HIGH TEMPERATURE PLASMAS Final Report, 1 Nov. 1966 - 30 Jun. 1973
John C. Corbin, Jr. Oct. 1973 15 p refs
(AF Proj. 7073)
(AD-773399; ARL-73-0116) Avail: NTIS CSCL 20/9

The report briefly summarizes results of research studies leading to the stabilization and control of plasma instabilities in a magnetic mirror device (ELMAX) of the Plasma Physics Research Laboratory during the period 1 November 1966 to 30 June 1973. Results are categorized under plasma source development, diagnostic methods, instabilities, stabilization, and theory. A complete listing of all publications/presentations is included. Feedback and parametric suppression of drift-type instabilities, development of time-resolved diagnostic methods for determining exact phase relationships among key plasma parameters, and extension of collisional drift wave theory are a few of the accomplishments cited. Author (GRA)

N74-20375# Mission Research Corp., Santa Barbara, Calif.
AN ANALYTIC BOUNDARY FOR THE MHD MAGNETIC FIELD EQUATION
W. W. White 29 Nov. 1973 27 p refs
(Contract DNA001-73-C-0138)
(AD-773913; MRC-R-92; DNA-3232T) Avail: NTIS CSCL 20/9

A magnetic field boundary condition for use with high altitude phenomenology codes has been developed. The solution of a boundary value problem in the region external to the MHD grid provides a current-free analytical approximation for the magnetic field outside the grid. The applicability of the current-free field as a boundary condition rests on the assumption that electrical currents of significance are contained within the MHD grid. Magnetic field data for a high altitude nuclear burst as computed by the MICE MHD code are presented. Author (GRA)

N74-20376# Colorado State Univ., Fort Collins. Dept. of Physics.
INVESTIGATIONS ON THE DYNAMICS OF MHD FLOWS Annual Summary Report, 1 Jan. - 31 Dec. 1973
Horst E. Wilhelm 15 Jan. 1974 90 p refs
(Contract N00014-67-A-0299-0008; NR Proj. 099-389)
(AD-773932) Avail: NTIS CSCL 20/9

The report is concerned with theoretical investigations on magnetohydrodynamic flows in advanced energy generators and energy sources. Similarity analyses are presented for compressible magnetohydrodynamic flows in diffusers with transverse magnetic fields (1) in the polytropic approximation and (2) with consideration of thermal dissipation processes. Graphical representations of the velocity and temperature distributions are given for various flow parameters. The electric potential and velocity fields in an electrically active liquid metal brush are calculated analytically and a criterion for the onset of backflow is derived. A similarity theory is developed for explosions and implosions in plasmas with nonlinear electron and ion thermal waves. Author (GRA)

N74-20377# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
BEAM HEATING IN PLASMA FOCUS
V. A. Gribkov, O. N. Krokhin, G. V. Sklizkov, N. V. Filippov, and T. I. Filippova 15 Jan. 1974 12 p refs Transl. into ENGLISH from Zh. Eksperim. Teor. Fiz., Pisma Redaktsiyu (Moscow), v. 18, no. 1, 5 Jul. 1973 p 11-14
(AD-773876; FTD-HT-23-710-74) Avail: NTIS CSCL 20/9

High-speed interferometric methods are used in this paper to show that the formation of powerful electron beams, which are subjected to hose instability and to focusing in a plasma, occurs during the terminal stage in plasma focus. The abnormal scattering of diagnosing laser radiation and the powerful roentgen radiation of a plasma from the beam focusing area indicate the development of double-beam instability and intense plasma heating in this region. This explains the basic neutron burst of this set-up. GRA

N74-20378# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CYLINDRICAL PROBE IN NITROGEN PLASMA OF GLOW-DISCHARGE AT MEAN PRESSURES
V. V. Danikov, E. P. Gruglyakov, and E. V. Shunko 17 Dec. 1973 16 p refs Transl. into ENGLISH from Zh. Prikl. Mekhan. Tekhn. Fiz., (Moscow), no. 2, Mar.-Apr. 1973 p 13-20
(AD-773291; FTD-HT-23-920-74) Avail: NTIS CSCL 20/9

The nitrogen plasma of a glow discharge is stabilized by means of Langmuir probes. A significant divergence in the plasma parameters (electron concentration, function of electron distribution with respect to energies) is obtained. Analysis of experimental data indicates the magnitude of plasma parameter distortions caused by working with the probes. Author (GRA)

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N74-20379 Case Western Reserve Univ., Cleveland, Ohio.
COMPARISON OF GaAs AND CdTe CRYSTALS FOR HIGH FREQUENCY INTRACAVITY COUPLING MODULATION OF CO2 LASERS Ph.D. Thesis
C. -C. Huang 1973 77 p
Avail: Univ. Microfilms Order No. 74-2529

Intracavity coupling modulation was achieved at 1 GHz, the

highest rate reported to date. Both GaAs and CdTe crystals were investigated and an optical beat method was used to explore the operational characteristics of such systems without having to go to the expense and trouble of high speed detectors. The modulation efficiencies at the 1 GHz modulation rate were .5% and 1% for GaAs and CdTe electrooptical modulators respectively. Modulator crystal characteristics such as electrical resistivity, radiation absorption, crystal uniformity, etc., which are of critical importance for intracavity modulation, have also been measured for both crystals. Dissert. Abstr.

N74-20380*# Linfield Research Inst., McMinnville, Oreg.
MEASUREMENT OF SINGLE CRYSTAL SURFACE PARAMETERS Final Report
L. W. Swanson, A. E. Bell, and R. W. Strayer Dec. 1972 77 p refs
(Grant NGR-38-010-005)
(NASA-CR-137362) Avail: NTIS HC $7.00 CSCL 20B

The sticking coefficient and thermal desorption spectra of Cs from the (110) plane of W was investigated. A sticking coefficient of unity for the monolayer region was measured for T < 250 K. Several distinct binding states were observed in the thermal desorption spectrum. Work function and electron reflection measurements were made on the (110) and (100) crystal faces of Mo. Both LEED and Auger were used to determine the orientation and cleanliness of the crystal surfaces. The work function values obtained for the (110) and (100) planes of Mo were 4.92 and 4.18 eV respectively. Author

N74-20381*# National Bureau of Standards, Washington, D.C.
ALKALI OXIDE-TANTALUM OXIDE AND ALKALI OXIDE-NIOBIUM OXIDE IONIC CONDUCTORS Final Report, Oct. 1972 - Oct. 1973
R. S. Roth, H. S. Parker, W. S. Brower, and D. Minor Apr. 1974 61 p refs
(NASA Order C-29933-C)
(NASA-CR-134599) Avail: NTIS HC $6.25 CSCL 20L

A search was made for new cationic conducting phases in alkali-tantalate and niobate systems. The phase equilibrium diagrams were constructed for the six binary systems Nb2O5-LiNbO3, Nb2O5-NaNbO3, Nb2O5-KNbO3, Ta2O5-NaTaO3, Ta2O5-LiTaO3, and Ta2O5-KTaO3. Various other binary and ternary systems were also examined. Pellets of nineteen phases were evaluated (by the sponsoring agency) by dielectric loss measurements. Attempts were made to grow large crystals of eight different phases. The system Ta2O5-KTaO3 contains at least three phases which showed peaks in dielectric loss vs. temperature. All three contain structures related to the tungsten bronzes with alkali ions in non-stoichiometric crystallographic positions. Author

N74-20382# Joint Publications Research Service, Arlington, Va.
STRUCTURE OF DIAMOND FILMS OBTAINED FROM THE GASEOUS PHASE UNDER LOW PRESSURES
B. V. Deryagin, B. V. Spitsyn, A. Ye. Aleksenko, A. Ye. Gorodetskiy, A. P. Zakharov, and R. I. Nazarova 29 Mar. 1974 7 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 213, no. 5, 1973 p 1059-1061
(JPRS-61606) Avail: NTIS HC $4.00

Results of an investigation of the structure of diamond films obtained at pressures below the atmospheric using an electron diffraction method are presented. Author

N74-20383# Istituto Superiore di Sanita, Rome (Italy). Lab. di Fisica.
ELECTROREFLECTANCE OF GaTe IN THE EXCITON ABSORPTION REGION
E. Burattini, M. Grandolfo, and C. Ranghiasci 3 Sep. 1973 18 p refs
(ISS-P-73/7) Avail: NTIS HC $4.00

Electro- and photoreflectance measurements in the exciton region at the fundamental edge of high quality GaTe single crystals are reported and discussed. To clarify the experimental lineshape delta R/R spectra have been transformed into the electric-field induced change delta epsilon sub 1, in the real part of the dielectric constant. A good agreement has been found with the theory which identifies low field electroreflectance as a resonant third-order nonlinear optical susceptibility. Author

N74-20384# National Inst. for Research in Nuclear Science, Chilton (England). Science Research Council.
HYPOTHESIS CONCERNING THE TRAINING PHENOMENON OBSERVED IN SUPERCONDUCTING MAGNETS
D. Evans Aug. 1973 15 p
(RL-73-92) Avail: NTIS

The phenomena of serrated yielding in metals strained at low temperatures and the training behavior observed in superconducting coils are related. This requires that at some point in the coil assembly the superconductor be subjected to a strain beyond the linear elastic limit. NSA

N74-20385# Brown Univ., Providence, R.I. Div. of Engineering.
DUCTILE VS BRITTLE BEHAVIOR OF CRYSTALS
J. R. Rice and R. Thomson (NBS, Washington, D.C.) May 1973 45 p
(Contract AT(11-1)-3084)
(COO-3084-22) Avail: NTIS HC $4.25

Aspects of the ductile vs brittle response of crystals are examined. Models are proposed for production of dislocations from crack tips in such ways that after expansion of the dislocations under external stress field, automatically sharp cracks are blunted by atomic planes. Various forces operating between cracks and dislocations are considered in two dimensions, and the activation energy is estimated for formation of dislocation half loops from cracks under the influence of these forces when energy barriers exist. An evaluation of experimental results is included. NSA

N74-20386# Minnesota Univ., Minneapolis. School of Physics and Astronomy.
EXPERIMENTAL AND THEORETICAL STUDIES IN SOLID STATE AND LOW TEMPERATURE PHYSICS Annual Progress Report, 1973
1973 55 p refs
(Contract AT(11-1)-1569)
(COO-1569-102) Avail: NTIS HC $4.75

Experimental and theoretical investigations have been carried out in a broad area of low temperature and solid state physics which includes superconductivity, theory of quantum crystals, magnetism in metals, and liquid helium. The pair field susceptibility of a superconductor has been determined both above and below T sub C. Anomalies in the heat capacity have been observed in thin superconducting films. The theory of quantum crystals has been applied to the problem of the ground state properties of nucleon matter. The results imply that most of the neutron matter in every neutron star is in the crystalline phase. Enhanced hyperfine nuclear cooling of PrCu6 has been used successfully to achieve temperatures to at least 3 mK with slow warmup. Measurements on local moments in metals using nuclear orientation are being carried out at these temperatures. Preliminary results have been obtained in measurements of the differential osmotic pressure in the critical region of He-3/He-4 mixtures. Author (NSA)

N74-20387# Cornell Univ., Ithaca, N.Y. Lab. of Atomic and Solid State Physics.
ONSET OF SUPERFLUID FLOW IN THIN HELIUM FILMS
J. M. Kosterlitz Oct. 1973 11 p refs Prepared in cooperation with Birmingham Univ.
(Contract AT(11-1)-3161)
(COO-3161-17) Avail: NTIS HC $3.00

The onset of superfluid flow in thin He II films is discussed on the basis of a recent theoretical model, and it is shown that it is in good agreement with experiments. Author (NSA)

N74-20388# Cornell Univ., Ithaca, N.Y. Materials Science Center.
MULTILAYERED THIN FILM SUPERCONDUCTORS M.S. Thesis
R. C. Rickenbach Jun. 1973 81 p refs Sponsored by NSF and AEC
(COO-3153-110; Rept-2041) Avail: NTIS HC $6.25

A vapor deposition system for the production of multilay-

ered thin films was built. The essential idea of the system is to evaporate the materials for both layer types simultaneously and to form the layered structure through the use of a rotating shutter which periodically intercepts one evaporation source and then the other. The system was used to make Pb-Al layered films. The thicknesses of the individual layers was varied from 60 to 600 A. Results from a preliminary study of the superconducting properties of the layered films are given. Author (NSA)

N74-20389# Cornell Univ., Ithaca, N.Y. Dept. of Materials Science.

STUDIES OF LOW TEMPERATURE PHASE TRANSFORMATION IN HIGH FIELD SUPERCONDUCTORS AND THE PHONON SPECTRUM AND MECHANICAL PROPERTIES OF VANADIUM Final Report

B. W. Batterman 1972 6 p refs

(Contract AT(11-1)-3164)

(COO-3164-5) Avail: NTIS HC $3.00

The structure and phase transformation of high field superconductors of the beta-tungsten type were studied. A phase transformation was discovered at 43 K in Nb3Sn and the structure of the low temperature phase was measured. The details of the transformation in terms of the formation of the low temperature tetragonal phase from the high temperature cubic phase was investigated both by X-ray observations and optical microscopy below 40 K. The complete phonon dispersion of vanadium was measured by X-ray diffuse scattering, thus complementing the neutron measurements on other body centered cubic elements. Incidental to the work on phonons in vanadium a strong effect was discovered which was related to hydrogen precipitations in vanadium. In separate electron microscopy studies the structure of the vanadium hydride phase was determined directly and the relative positions of the hydrogen atoms were determined.

Author (NSA)

N74-20390# Army Materials and Mechanics Research Center, Watertown, Mass.

PHYSICAL PROPERTIES OF RARE EARTH-COBALT MAGNET MATERIALS Final Report, 1 Jul. 1972 - 31 Mar. 1973

David R. Chipman and Laurence D. Jennings, Jr. Nov. 1973 22 p refs

(ARPA Order 1914)

(AD-772954; AMMRC-TR-73-52) Avail: NTIS CSCL 20/12

To further define the various types of time dependences noted previously, attempts were made to return a sample to its original state. Because of the failure of these, a series of samples with nearly identical properties is being investigated. Some preliminary results are given. High temperature X-ray measurements were made of prism plane reflections. These yielded thermal expansion values in the basal plane showing no anomaly at the Curie Temperature. The widths of the X-ray lines were a function of temperature and also of previous heat treatments. The width variations are reported in some detail and attributed both to bulk and surface effects. The temperature factor was measured and can be interpreted through a Debye temperature of 281.

Author (GRA)

N74-20391# Pomona Coll., Claremont, Calif. Dept. of Physics.

MAGNETO-OPTICAL STUDY OF FERROMAGNETIC DOMAINS Final Report

Charles A. Fowler, Jr. 15 Jan. 1974 7 p refs

(Contract N00014-71-C-0148; NR Proj. 018-303)

(AD-773104; Rept-13) Avail: NTIS CSCL 20/12

The report summarizes the results of three research tasks undertaken under the contract: (1) Magneto-optic Rotation Enhancement in Thin Magnetic Films; (2) Phase Detection of Magneto-optic Signals; and, (3) Magnetically Induced Birefringence in Thin Magnetic Films. GRA

N74-20392# Army Foreign Science and Technology Center, Charlottesville, Va.

ELECTRICAL PROPERTIES OF THE DIFFUSION P-N JUNCTURES OF P-TYPE GALLIUM ARSENIDE

S. V. Mashnin and S. S. Khludkov 26 Nov. 1973 7 p refs Transl. into ENGLISH from Tomsk State Univ. Bull. (Tomsk), no. 3, 1970 p 281-284

(AD-772425; FSTC-HT-23-2243-72) Avail: NTIS CSCL 20/12

The paper discusses results of research on the influence of cooling on the volt-ampere characteristic of p-n junctions obtained by the diffusion of sulphur and tin. The relationship of the spark-over voltage to the gradient of concentration of the mixture in the field of the space charge and of the critical voltage of the electric field in a p-n junction from the width of the field of the space charge is also discussed. GRA

N74-20393# California Univ., La Jolla. Dept. of Physics.

WANNIER FUNCTIONS IN CRYSTALS WITH SURFACES

John J. Rehr and Walter Kohn Jan. 1974 30 p refs

(Contract N00014-69-A-0200-6026; NR Proj. 017-653)

(AD-773742; TR-24) Avail: NTIS CSCL 20/12

Generalized Wannier Functions (GWF) are defined for one-dimensional crystals with surfaces, using an approach similar to that developed by Kohn and Onffroy for crystals with impurities. The authors show how an appropriate set of exponentially localized, orthonormal GWF may be constructed for each band of the crystal; both the surface states and bulk states associated with a given band can be expressed as linear combinations of these GWF. The GWF have the same exponential decay into the crystal as the Wannier Functions (WF) of the infinite lattice, even though the surface states themselves may have a longer range. In addition successive GWF, starting from the surface, reduce to the WF in an exponential manner. These localization properties give the GWF several advantages over the energy eigenstates as a set of basis functions; and, using variational methods, they may actually be easier to compute.

Author (GRA)

N74-20394# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

STRUCTURAL PROPERTIES OF AMORPHOUS SEMICONDUCTORS BY MOSSBAUER SPECTROSCOPY Semiannual Technical Report

Norman Blum 30 Nov. 1973 16 p refs

(Contract N00017-72-C-4401; ARPA Order 1562)

(AD-773647; AROD-9823-4-P; SATR-3) Avail: NTIS CSCL 20/12

Comparison of the 125Te Mossbauer spectra in amorphous and crystalline Te films indicates that in the amorphous phase the quadrupole splitting is about 20% greater and the recoil-free fraction about one-third as great as in the crystalline phase. The increase in quadrupole splitting is interpreted as indicating a decrease of about 3% in the length of the covalent bond between the nearest neighbor Te atoms in the amorphous state. The decrease in recoil-free fraction in the amorphous film is explained as due to dangling bonds at the ends of the Te chains which are responsible for a change in the density of phonon states in the system. A short paper covering this work has been prepared and is included as an Appendix to this report.

GRA

N74-20395# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

STATE AND PROSPECTS OF RADIATION PHYSICS OF SEMICONDUCTORS OF A2B6 COMPOUNDS

A. P. Galushka and I. D. Konozenko 8 Jan. 1974 20 p refs Transl. into ENGLISH from Radiats. Fiz. Nemetal. Krist., Sb. Statei (USSR), v. 3, no. 1, 1971 p 28-42

(AD-773265; FTD-HT-23-92-74) Avail: NTIS CSCL 20/12

In recent years the use of systems and devices containing A2B6 compounds under nuclear radiation conditions has grown steadily. This has made it possible to study the interaction of these compounds with various ionizing radiations. The results of such studies have a substantial effect on the possibilities of practical application of these compounds and on the development of physical concepts concerning the phenomena which occur in them under the influence of radiation. In studying defects in solid bodies the most interesting and important subject is the role of the actual defects in determining the properties of the material. Specifically, vacancies and interstices in matrix atoms often determine the useful properties of the materials or, conversely, can seriously limit the use of a material. GRA

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N74-20396 Princeton Univ., N.J.
THE MECHANISM OF SUPER-RATE BURNING OF CATALYZED DOUBLE BASE PROPELLANTS Ph.D. Thesis
Naminosuke Kubota 1973 218 p
Avail: Univ. Microfilms Order No. 74-2341

Organic lead salts used as catalysts alter the burning mechanisms of double base propellants to produce burning rate increases and domains of reduced burning rate pressure sensitivity. Simultaneously, these same lead salts greatly reduce the temperature sensitivity of burning rate in the super-rate range. These effects provide design flexibility and yield performance which is largely constant over a prescribed range of operating pressures and initial temperatures. Investigations were carried out with particulate nitrocellulose and trimethylothane trinitrate double base propellants. Dissert. Abstr.

N74-20397*# National Aeronautics and Space Administration. Pasadena Office, Calif.
PREVENTION OF HYDROGEN EMBRITTLEMENT OF HIGH STRENGTH STEEL Patent Application
Leonard Weber, inventor (to NASA) (McDonnell-Douglas Corp., Santa Monica, Calif.) Filed 28 Sep. 1973 10 p
(Contract NAS7-811)
(NASA-Case-NPO-12122-1; US-Patent-Appl-SN-401921) Avail: NTIS HC $4.00 CSCL 21I

Delayed failure of high strength steel alloys exposed to compositions containing hydrazine is prevented by addition of potassium hydroxide to the composition in an amount at least sufficient to neutralize acidic impurities. The removal of the acidic impurities eliminates evolution of hydrogen and thus avoids hydrogen embrittlement of the high strength steel alloys. NASA

N74-20398# Bell Aerospace Co., Buffalo, N.Y.
PROPELLANT IMPROVEMENT PROGRAM. VOLUME 1, PART 2: MODIFIED HDA STUDIES Special Technical Report, Mar. 1972 - Jul. 1973
Henry Ph. Heubusch Oct. 1973 122 p refs
(Contract F04611-72-C-0026)
(AD-773332; AFRPL-TR-73-77; Rept-8643-928004) Avail: NTIS CSCL 21/9

Three compounds were compared as replacements for HF as the corrosion inhibitor for HDA (High Density Acid). The compounds, all containing phosphorous and fluorine, were AHP (Ammonium heda fluorophosphate) PF5, and monofluorophosphoric acid. Comparison was based on results of 30-day, 90F, static corrosion tests with 6061 aluminum and 347 stainless steel. The inhibitors were tested at three or four levels of concentration and the metals were exposed separately to acid vapors and liquid. Best results were with PF5 and AHP when used in the range 0.4 to 0.6 wt %. Preference for these inhibitors over HF was further extended through 7-day tests at 120F with other metals and non-metals. In all, 26 materials were tested and the great majority were more compatible with the non-HF inhibitors. The most striking observation was reduction of stainless steels from a Class II (Short Term Usage) to a Class I (Satisfactory for General Use) rating. Analytical methods were developed in the course of the program for colorimetric determination of the corrosion inhibitor and atomic absorption determinations of iron, chromium, and nickel. (Modified author abstract) GRA

N74-20399# Stanford Research Inst., Menlo Park, Calif.
THE CHEMISTRY OF FUEL DEPOSITS AND THEIR PRECURSORS Final Report, 28 Dec. 1972 - 27 Dec. 1973
Frank R. Mayo, Harold Richardson, and Guillermo D. Maydrga Dec. 1973 45 p refs
(Contract N00019-73-C-0318)
(AD-773630) Avail: NTIS CSCL 21/4

Oxidation and condensation products of a standard jet fuel at 190-200C have been concentrated and fractionated to give materials of average molecular weight of >300 by (1) precipitation from pentane and (2) gel permeation chromatography. Heating fuel with stainless steel wool and oxygen at 200C has given insoluble deposits that can be removed only by heating in air. A deposit from a simulated fuel manifold has been analyzed. Some contemporary work on fuel stability has been reviewed and recommendations for further work toward a useful stability test are presented. (Modified author abstract) GRA

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N74-20400*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
EVALUATION OF SHUTTLE SOLID ROCKET BOOSTER CASE MATERIALS. CORROSION AND STRESS CORROSION SUSCEPTIBILITY OF SEVERAL HIGH TEMPERATURE MATERIALS Technical Report, 19 May 1972 - 19 Oct. 1973
L. J. Pionke and K. C. Garland 28 Dec. 1973 100 p refs
(Contract NAS8-27270)
(NASA-CR-120160; MDC-E0891) Avail: NTIS HC $8.00 CSCL 21H

Candidate alloys for the Shuttle Solid Rocket Booster (SRB) case were tested under simulated service conditions to define subcritical flaw growth behavior under both sustained and cyclic loading conditions. The materials evaluated were D6AC and 18 Ni maraging steel, both heat treated to a nominal yield strength of 1380 MN/sq m (200 ksi). The sustained load tests were conducted by exposing precracked, stressed specimens of both alloys to alternate immersion in synthetic sea water. It was found that the corrosion and stress corrosion resistance of the 18 Ni maraging steel were superior to that of the D6AC steel under these test conditions. It was also found that austenitizing temperature had little influence on the threshold stress intensity of the D6AC. The cyclic tests were conducted by subjecting precracked surface-flawed specimens of both alloys to repeated load/thermal/environmental profiles which were selected to simulate the SRB missions. It was found that linear removal operations that involve heating to 589 K (600 F) cause a decrease in cyclic life of D6AC steel relative to those tests conducted with no thermal cycling. Author

N74-20401# Advisory Group for Aerospace Research and Development. Paris (France).
V/STOL PROPULSION SYSTEMS
Jan. 1974 415 p refs Mostly in ENGLISH; partly in FRENCH
Presented at the 42d Meeting of the AGARD Propulsion and Energetics Panel, Schliersee, Germany, 17-21 Sep. 1973
(AGARD-CP-135) Avail: NTIS HC $23.75

The proceedings of a conference on V/STOL propulsion systems are presented. The subjects discussed include the following: (1) optimum engines for military V/STOL aircraft, (2) engine cycle selection for commercial short takeoff aircraft, (3) requirements for V/STOL propulsion and drive train components, (4) development of advanced technology V/STOL propeller system, (5) engine and aircraft design considerations affecting aircraft noise, (6) characteristics of lifting fans under cross flow conditions, and (7) operational experience with V/STOL propulsion systems. For individual titles, see N74-20402 through N74-20433.

N74-20402 Motoren- und Turbinen-Union Muenchen G.m.b.H. (West Germany).
COMPARATIVE APPRAISAL OF PROPULSION SYSTEMS FOR VTOL-AIRCRAFT
Heinrich Leibach *In* AGARD V/STOL Propulsion Systems Jan. 1974 19 p (For availability see N74-20401 11-28)

An engine-oriented method for a functional description and classification of all existing and future aircraft jet propulsion

systems is presented. It is assumed that all aero propulsion systems are made up of assemblies which carry out the thrust generation, thrust augmentation and thrust control functions, with various principles of operation being possible, as well as various combinations of the said assemblies. If these three fundamental functions are determined symbolically and free-of-value, it will be possible to obtain a basic description and a classification of all existing and future engines, via the determination of the energy flows. Moreover, this classification method will permit derivation and description of new, unconventional power plants. Author

N74-20403 Rolls-Royce, Ltd., Bristol (England). Engine Div.
OPTIMUM ENGINES FOR MILITARY V/STOL AIRCRAFT
R. M. Denning and N. A. Mitchell *In* AGARD V/STOL Propulsion Systems Jan. 1974 13 p (For availability see N74-20401 11-28)

The characteristics of propulsion systems for V/STOL low-level close support and air superiority aircraft are discussed. The requirements for optimum engines based on the operational requirements of the aircraft are explained. Charts, graphs, and diagrams are provided to show the evolution of military V/STOL combat aircraft and the associated propulsion systems. Author

N74-20404 Naval Air Systems Command, Washington, D.C.
FORMULATING MILITARY REQUIREMENTS
R. L. VonGerichten *In* AGARD V/STOL Propulsion Systems Jan. 1974 12 p refs (For availability see N74-20401 11-28)

The formulation of military requirements often includes conflicting elements and may follow several different paths. Many diverse technical concepts which are in varying stages of development must be considered. The formulation process is discussed and some of the technical and design considerations are highlighted. The inception of the Navy's V/STOL Fighter-Attack Program is reviewed together with some indication of the progress on the Navy's Medium V/TOL Program. Both of which are being considered for the Sea Control Ship and other applications. Additional constraints on propulsion system development and thoughts of future propulsion requirements are provided. Author

N74-20405 Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Villaroche (France).
THE MOTORIZATION OF SHORT TAKE-OFF AND LANDING AIRCRAFT [LA MOTORISATION DES AVIONS A DECOLLAGE ET A ATTERRISSAGE COURTS]
Robert Laurens *In* AGARD V/STOL Propulsion Systems Jan. 1974 16 p In FRENCH (For availability see N74-20401 11-28)

The operational and environmental requirements for STOL aircraft such as airfield length, noise restrictions and pollution limitations are reviewed and commented on in view of the subsequent engine requirements. The choice of thermodynamic cycle for optimum take-off/cruise thrust matching and economical sfc and the main design parameters influencing fan noise are discussed. Special attention is paid to the improvements in engine handling made possible by the use of variable nozzles and/or variable pitch fans. This allows low thrust levels at high fan speeds, resulting in favorable engine response times, important for baulked landings and thrust reversal. Author

N74-20406 Motoren- und Turbinen-Union Muenchen G.m.b.H. (West Germany).
INVESTIGATION OF THE RELATIVE MERITS OF DIFFERENT POWER PLANTS FOR STOL-AIRCRAFT WITH BLOWN FLAP APPLICATION
H. Grieb, W. Klussmann, and G. Weist *In* AGARD V/STOL Propulsion Systems Jan. 1974 19 p refs (For availability see N74-20401 11-28)

The relative merits of different air supply systems for STOL-aircraft with blown flap application are investigated. Under consideration are self-sustained supply units, such as gas turbine driven compressors, remote compressors driven with hot gas from the cruise engines and 2 possibilities for off-take of compressed air from the cruise engines. The air supply systems reviewed are compared with respect to the design requirements, the operating behaviour including any reactions on the cruise engines, the sensitivity to component failure and the weight penalty to be expected. Author

N74-20407 Royal Aircraft Establishment, Bedford (England).
A THEORETICAL AND EXPERIMENTAL INVESTIGATION OF THE EXTERNAL-FLOW, JET-AUGMENTED FLAP c02
P. R. Ashill *In* AGARD V/STOL Propulsion Systems Jan. 1974 18 p refs (For availability see N74-20401 11-28)

Theoretical methods for calculating the forces and moments acting on wings with external-flow, jet-augmented flaps are discussed. One of the simplest of these relies on the analogy between the internal-flow, jet flap and the external-flow, jet flap. To date, this method has been limited in application by its reliance on either measured or assumed value of the jet-deflection angle and the thrust-recovery factor, i.e. the factor that is applied to the momentum flux leaving the exit of the engine nacelle to allow for turning and spreading losses. This paper is concerned with a semi-empirical method for predicting these parameters. The method is based on an analysis of a series of tests performed on a wing, body and injector-powered nacelle under static conditions. The formulas derived from the analysis are combined with a theory, which is based on the jet-flap analogy, to provide estimates of the forces and moments acting on wings with external-flow, jet-augmented flaps in forward flight. Comparisons are made between this method and wind-tunnel data obtained from tests performed at the RAE and elsewhere. Author

N74-20408 Fiat S.p.A., Turin (Italy). Div. Aviazione.
ENGINE CYCLE SELECTION FOR COMMERCIAL STOL AIRCRAFT
Giorgio Feo and Alfredo Capuani (Societa Aeritalia, Turin) *In* AGARD V/STOL Propulsion Systems Jan. 1974 11 p (For availability see N74-20401 11-28)

The cycle and design parameters pertinent to a turbofan to be used for STOL short haul applications have been studied. For the chosen aircraft configuration, the criteria that condition the choice of the cycle, listed in decreasing importance, have been determined as follows: (1) low noise level, (2) high specific thrust to obtain low-weight and reduced-size engines, and (3) low specific fuel consumption (s.f.c.). It is concluded that the controlling factor is the noise level requirement for airports in congested areas. In order to satisfy this and the mission operational requirements the turbofan engine is driven towards medium bypass ratios and high thrust weight ratios but with less emphasis on s.f.c. Author

N74-20409 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).
WIND TUNNEL TESTING WITH ENGINE SIMULATION FOR V/STOL AIRPLANES
R. Wulf and E. Melzer *In* AGARD V/STOL Propulsion Systems Jan. 1974 14 p refs (For availability see N74-20401 11-28)

For the development of STOL and expecially for VTOL airplanes with modern engines, wind tunnel testing with adequate jet and engine simulation is of great importance. Current engine systems are classified. Their main characteristics concerning the aerodynamic interference between engine and airplane or between engine and the surrounding flow field are described. Based on these aspects suitable simulation systems are discussed. The power requirement for exact simulation is estimated and in the case of compressed air supply the influence of pressure ratio and temperature is shown. Some simulators developed and used in the last few years illustrate the different testing techniques for compressed air blowing, ejectors, and tip turbine driven fans. Concluding remarks present some proposals for a future collaborative program of work in the field of engine simulation. Author

N74-20410 General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
RECENT TECHNOLOGY ADVANCES IN THRUST VECTORING SYSTEMS
Richard P. Taylor and Joseph A. Lander *In* AGARD V/STOL Propulsion Systems Jan. 1974 11 p refs (For availability see N74-20401 11-28)

The important technical challenges that must be overcome in order to make a reality of thrust vectoring of an afterburning engine for a multi-mission aircraft. Two approaches to vectoring - with and without afterburning in lift are described which have been developed to the point that they are available for

direct application to an engine development program. In addition, the evaluation/selection/design criteria for vectoring systems have developed to the point where specific design and configuration considerations that are peculiar to VTOL are identified and reasonably well understood. Thus, although the engine and aircraft industry continue the search for and development of even better thrust vectoring systems and installations, it is considered that the fundamental technology and knowhow is available to proceed with a thrust vectored, afterburning engine and aircraft. Author

N74-20411 Societe Nationale Industrielle Aerospatiale, Paris (France).
SHORT HAUL AIRCRAFT ADAPTATION TO THE USE OF SHORT LANDING FIELDS [ADAPTATION MOTEURS-CELLULE DES AVIONS COURTS COURRIERS UTILISANT DES PISTES COURTES] c02
Pierre Guyot *In* AGARD V/STOL Propulsion Systems Jan. 1974 11 p In FRENCH (For availability see N74-20401 11-28)

The results of an engine/airframe optimization study carried out in order to investigate the effect that field length has on aircraft weight and direct operating costs are given. The study uses an aircraft with a fixed passenger load, flight plan and aerodynamic characteristics, and an engine with a fixed gas generator. The two main parameters are then wing loading and bypass ratio. It was concluded that there is a considerable penalty in operating costs for shortening the field length. Author

N74-20412 Army Air Mobility Research and Development Lab., Cleveland, Ohio.
BASIC RESEARCH REQUIREMENTS FOR V/STOL PROPULSION AND DRIVE-TRAIN COMPONENTS
John Acurio *In* AGARD V/STOL Propulsion Systems Jan. 1974 14 p (For availability see N74-20401 11-28)

The design of aircraft engines for use with V/STOL aircraft is discussed. Emphasis is placed on the aerodynamic components of the engine. The subjects discussed are as follows: (1) general requirements, (2) compressors, (3) turbines, (4) combustors, and (5) drive train concepts. Graphs of engine performance under various operating conditions are provided. Author

N74-20413 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany).
AERODYNAMIC INTERFERENCE BETWEEN FUSELAGE AND LIFTING JETS EMERGING FROM ITS LOWER PART c02
G. Viehweger *In* AGARD V/STOL Propulsion Systems Jan. 1974 14 p refs (For availability see N74-20401 11-28)

In a basic experimental study on a cylindrical fuselage, the change in lift and pitching moment induced by two lifting jets of high velocity, situated one behind the other, is determined. The constructional principle of the model permits a wide variation of fuselage length, of the distance between the jets and the diameter of the jet nozzles. As aerodynamic parameters the angle of attack, the location of a wing relative to the jet nozzles, the mainstream and the jets velocities are varied within a wide range. The pressure distribution on the whole surface of the cylindrical fuselage central section is measured. The results provide a survey on the influence of the different parameters. The aerodynamic problems are discussed. The experimental installation and the performance of the tests are described. Author

N74-20414 Army Air Mobility Research and Development Lab., Fort Eustis, Va.
RESEARCH TOWARD DEVELOPMENT FEASIBILITY OF AN ADVANCED TECHNOLOGY V/STOL PROPELLER SYSTEM c02
James Gomez, Jr. and Robert M. Levintan *In* AGARD V/STOL Propulsion Systems Jan. 1974 12 p refs Prepared in cooperation with Hamilton Standard Div., United Aircraft Corp., Windsor Locks, Conn. (For availability see N74-20401 11-28)

Analytical studies and limited hardware efforts have shown that improvements can be obtained in V/STOL propeller components through the use of improved materials and new concepts. Several of the design concepts which evolved from a baseline feasibility study were explored. Some have been partially proven and others require significantly more research than anticipated. Laboratory test work to date on the boron-aluminum blade spar indicates that the material characteristics are ideal for a propeller environment. However, the efforts expended for research on titanium gear tooth coatings have indicated that much more research is necessary. Author

N74-20415 Motoren- und Turbinen-Union Muenchen G.m.b.H. (West Germany).
THE INFLUENCE OF THE CONTROL CONCEPT FOR V/STOL ENGINES ON THEIR STATIC AND DYNAMIC PERFORMANCE CHARACTERISTICS
K. Bauerfeind and G. Doepner *In* AGARD V/STOL Propulsion Systems Jan. 1974 13 p refs (For availability see N74-20401 11-28)

The decrease of total thrust and the changes of important engine parameters of two-spool bypass engines caused by bleeding air upstream of the combustion chamber for stabilizing and for maneuvering VTOL-aircraft in the hover or transition phase have been investigated. A variation of the engine design parameters turbine inlet temperature, total pressure ratio and bypass ratio has been considered. In each case three different control concepts have been applied: (1) the power lever position calls for a constant fuel flow, (2) the power lever position calls for a constant HP-compressor speed, and (3) the power lever position calls for a constant turbine inlet temperature. The smallest decrease in total thrust results when the HP-compressor speed is kept constant, when the total pressure ratio is 20 or above and the bypass ratio is between 2 and 10. The design turbine inlet temperature only has a minor effect on this. But, on the other hand, the increase of turbine inlet temperature due to bleeding air is very high. The biggest decrease in total thrust occurs when the turbine inlet temperature is kept constant by the control system and when the engine has a high bypass ratio and also a high design turbine inlet temperature. Author

N74-20416* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INTEGRATED PROPULSION/ENERGY TRANSFER CONTROL SYSTEMS FOR LIFT-FAN V/STOL AIRCRAFT c02
Wallace H. Deckert and L. Stewart Rolls *In* AGARD V/STOL Propulsion Systems Jan. 1974 8 p refs (For availability see N74-20401 11-28)

An integrated propulsion/control system for lift-fan transport aircraft is described. System behavior from full-scale experimental and piloted simulator investigations are reported. The lift-fan transport is a promising concept for short-to-medium haul civil transportation and for other missions. The lift-fan transport concept features high cruise airspeed, favorable ride qualities, small perceived noise footprints, high utilization, transportation system flexibility, and adaptability to VTOL, V/STOL, or STOL configurations. The lift-fan transport has high direct operating costs in comparison to conventional aircraft, primarily because of propulsion system and aircraft low-speed control system installation requirements. An integrated lift-fan propulsion system/aircraft low-speed control system that reduces total propulsion system and control system installation requirements is discussed. Author

N74-20417 Pratt and Whitney Aircraft, East Hartford, Conn.
V/STOL DEFLECTOR DUCT PROFILE STUDY c12
R. I. Strough and T. A. Wynosky *In* AGARD V/STOL Propulsion Systems Jan. 1974 13 p (For availability see N74-20401 11-28)

V/STOL deflection of exhaust gases creates static pressure gradients within deflector system ducting which propagate upstream and produce a nonsymmetric back-pressure distribution on the fan. Depending on the deflector design, the fan will experience a higher-than-average back-pressure at one point in the duct, and lower-than-average pressure near the deflector. If this back-pressure distortion is severe enough, engine stability can be compromised. Experimental and analytical studies were conducted to study the back-pressure distortion problem. Small-scale cold flow models of various deflector devices were tested to obtain a parametric mapping of the back-pressure disturbance as a function of bypass ratio, duct Mach number, and deflector geometric parameters. Screens of varying solidity were used to generate total pressure gradients around the duct similar to those generated by the fan. The parametric distortion

patterns were then duplicated on a specially designed full-scale fan test rig, and fan surge margin degradation was related to the generated back-pressure profile. The final analysis resulted in the formulation of design ground rules which establish criteria for the disturbance proximity and magnitude that current turbomachinery can tolerate. Author

N74-20418 Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Villaroche (France).
LOW SPEED TURBINE GEAR BOX [TURBINE LENTE CONTRE BOITE D'ENGRENAGES]
Victor Bensimhon *In* AGARD V/STOL Propulsion Systems Jan. 1974 17 p In FRENCH (For availability see N74-20401 11-28)

A propulsion system is proposed where a low speed highly loaded turbine driven by two gas generators is coupled directly to the rotor shaft, thus avoiding the heavy gear box. A description is given of the mechanical and aerodynamic characteristics of this propulsion system and its capability to meet the requirements various operating conditions, including high speed flight with propulsion support by the turbojets used as gas generators for the rotor turbine. The system described is compared with a conventional propulsion system with respect to fuel consumption and maintenance cost. Author

N74-20419 Aerospace Research Labs., Wright-Patterson AFB, Ohio. Energy Conversion Lab.
COMPACT THRUST AUGMENTORS FOR V/STOL AIRCRAFT
Brian Quinn *In* AGARD V/STOL Propulsion Systems Jan. 1974 12 p refs (For availability see N74-20401 11-28)

The prospect of undertaking V/STOL and cruise flight with the same powerplant has considerable appeal and can be achieved by proper use of thrust augmenting ejectors. Proper use requires an ejector that simultaneously satisfies two conflicting requirements: high performance and installation compactness. In addition to elementary design considerations, the following paragraphs discuss the loss mechanisms to which augmentors are most sensitive and describe how they may be manipulated to produce high levels of thrust augmentation in ejectors suitable for V/STOL aircraft. Conclusions are corroborated by the results of experimental investigations of the effects of geometric constraints on the flow structure and performance of thrust augmenting ejectors. Author

N74-20420 National Research Council of Canada, Ottawa (Ontario). Gas Dynamics Lab.
THRUST PERFORMANCE OF PODDED LIFT-FANS IN CROSSFLOW c02
R. A. Tyler and R. G. Williamson *In* AGARD V/STOL Propulsion Systems Jan. 1974 14 p refs (For availability see N74-20401 11-28)

Experimental data relating to the thrust performance in crossflow of single, individually podded, lift-fans are discussed. Various 15-inch tip diameter fan arrangements were tested over a range of crossflow velocity ratio typical of the transition flight profiles of proposed lift-fan aircraft. Each model was operated in isolation in a manner allowing fan thrust (efflux momentum) to be assessed directly from force-balance measurements. The relevant transition conditions, in association with practical dimensional restrictions on intake geometry for separately cowled fans (in, for instance, multiple in-line arrangement) suggest that lip flow separation could be an important feature of the inflow distortion arising from crossflow. In such circumstances thrust deterioration with increasing crossflow velocity is appreciable. The measured data illustrate the influence on fan thrust sensitivity to crossflow of various installational features including fan operating point, cowl lip radius, inlet axial depth, and crossflow angle. Author

N74-20421 National Gas Turbine Establishment, Pyestock (England).
SOME ENGINE AND AIRCRAFT DESIGN CONSIDERATIONS AFFECTING NOISE c02
D. R. Higton and T. A. Cook (Roy. Aircraft Estab., Farnborough, Engl.) *In* AGARD V/STOL Propulsion Systems Jan. 1974 9 p ref Prepared in cooperation with Roy. Aircraft Estab., Farnborough, Engl. (For availability see N74-20401 11-28)

The general prospects for further reductions in engine noise are reviewed. The factors which determine the best combination of engine specific thrust (or by-pass ratio) and complexity of acoustic treatment are assessed. The effect of design requirements, particularly that of field length, on aircraft noise and economics is then discussed, together with the prospects for manipulating airframe design parameters in order to reduce noise. Quantitative consideration of noise shielding is not included; this can be regarded as an important effect meriting a separate study. Some of the interactions between engine and aircraft design as they affect the economics and noise of conventional short range aircraft for short to medium field lengths are analyzed. Author

N74-20422* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INFLUENCE OF NOISE REQUIREMENTS ON STOL PROPULSION SYSTEM DESIGNS
Raymond J. Rulis *In* AGARD V/STOL Propulsion Systems Jan. 1974 17 p refs (For availability see N74-20401 11-28)

The severity of proposed noise goals for STOL systems has resulted in a new design approach for aircraft propulsion systems. It has become necessary to consider the influence of the noise goal on the design of engine components, engine systems, and the integrated nacelle, separately and collectively, from the onset of the design effort. This integrated system design approach is required in order to effect an optimization of the propulsion and aircraft system. Results from extensive design studies and pertinent test programs are presented which show the effect of noise specifications on component and system design, and the trade-offs possible of noise versus configuration and performance. The design optimization process of propulsion systems for powered lift systems is presented beginning with the component level and proceeding through to the final integrated propulsion system. Designs are presented which are capable of meeting future STOL noise regulations and the performance, installation and economic penalties are assessed as a function of noise level. Author

N74-20423 Dowty Rotol Ltd., Gloucester (England).
THE INFLUENCE OF NOISE REQUIREMENTS ON STOL AIRCRAFT ENGINE DESIGN
D. G. M. Davis *In* AGARD V/STOL Propulsion Systems Jan. 1974 11 p refs (For availability see N74-20401 11-28)

The noise regulations applicable to STOL aircraft are discussed. It is stated that the current aircraft fail to meet the noise regulations and that a reduction of 10 to 15 PNdB must be achieved. An even greater reduction of 25 to 30 PNdB is required to make the aircraft acceptable to city center STOL landing areas. Aircraft performance parameters and flight path considerations which will contribute to a reduction in noise levels are described. A turbofan engine of relatively high bypass ratio fitted with a variable pitch fan is proposed as the basic power plant. Author

N74-20424 Hamilton Standard, Windsor Locks, Conn. Aircraft Systems Dept.
Q-FAN PROPULSION FOR SHORT HAUL TRANSPORTS
Arthur H. Jackson, Jr. *In* AGARD V/STOL Propulsion Systems Jan. 1974 12 p refs (For availability see N74-20401 11-28)

The design and development of quiet fans (Q-FAN) for use with short haul transport aircraft are described. The Q-FAN blade construction is analyzed to show the effectiveness in noise reduction. The Q-FAN uses variable pitch techniques and is especially effective for thrust reversal operations. The advantages of variable thrust are: (1) superior thrust response and lower engine noise on landing approach, (2) lower fuel consumption at part power conditions, (3) slightly higher thrust and lower fuel consumption at cruise, and (4) bladu feathering protection from destructive engine failure. Author

N74-20425 National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.
AERODYNAMIC CHARACTERISTICS OF AN EXPERIMENTAL LIFTING FAN UNDER CROSSFLOW CONDITIONS c02
U. W. Schaub *In* AGARD V/STOL Propulsion Systems Jan. 1974 16 p refs (For availability see N74-20401 11-28)

The fundamental nature of crossflow distortion and the effect on lifting fan performance are discussed. The experimental

procedure for determining cross flow effects is described. Diagrams are provided to show: (1) general flow curvature effect, (2) flow curvature effects in an annular inlet, and (3) crossflow/inlet flow streamline pattern. The causes and appearance of outlet plane distortion are analyzed. Graphs of the total pressure ratio-mass flow running lines of the complete fan and sub-fan elements are provided. Author

N74-20426 National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.
NOISE CHARACTERISTICS OF AN EXPERIMENTAL LIFTING FAN UNDER CROSSFLOW CONDITIONS c02
G. Krishnappa *In* AGARD V/STOL Propulsion Systems Jan. 1974 14 p refs (For availability see N74-20401 11-28)

The results of acoustic tests conducted on a 12-in. diameter model lifting fan, to find the effect of crossflow on its noise radiation characteristics are presented. The broadband noise levels increased with the velocity of the crossflow. The fundamental blade passing frequency and its second harmonic tones showed moderate changes in the field shapes and levels for low crossflows. At high crossflow velocities due to the presence of a partial stalled region the tone levels increased drastically. The tones generated by the rotor blades due to inflow distortions were believed to dominate over the rotor and stator interaction levels. At fan speeds close to the design point, there were only slight changes in the tone levels and field shapes at the blade passing frequency as the blade incidence excursions became less severe and rotor and stator interaction was much stronger. However, at the higher crossflow velocities the second harmonic tones showed substantial reductions in tone levels with different field shapes. Author

N74-20427 Detroit Diesel Allison, Indianapolis, Ind.
COST OF OWNERSHIP FOR PROPULSION SYSTEM OF POWERED LIFT AIRCRAFT c34
W. L. McIntire *In* AGARD V/STOL Propulsion Systems Jan. 1974 20 p refs (For availability see N74-20401 11-28)

A discussion of the relationship of advanced propulsion technology for powered lift V/STOL aircraft and the elements of cost of ownership - development, acquisition, and operation and maintenance is presented. Competitive demonstrator programs, component technology versus aircraft, and mission requirements and implementation of design-to-cost programs are discussed as basic cost considerations for the development program element of cost of ownership. Production requirements and manufacturing methods required for new materials and advanced aerodynamic components are presented as the second cost of ownership parameter to provide acquisition costs effectively balanced with performance and cost. Finally, system performance, reliability, and maintainability are evaluated to ensure that the total cost of ownership is commensurate with the job to be done. Author

N74-20428 Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Unternehmensbereich Flugzeuge.
PROPULSION SYSTEM OF THE VJ 101 C VTOL AIRCRAFT: PHILOSOPHY AND PRACTICAL EXPERIENCE
Werner Biehl *In* AGARD V/STOL Propulsion Systems Jan. 1974 14 p refs (For availability see N74-20401 11-28)

The design and development of the VJ 101C vertical takeoff aircraft are discussed. Emphasis is placed on optimizing the aircraft configuration with respect to the propulsion system. The special requirements for the engines and intakes to provide a vertical takeoff and supersonic flight capability are analyzed. The problem areas considered are as follows: (1) thrust modulation for attitude control, (2) afterburner thrust for vertical takeoff, (3) hot gas reingestion, (4) ground suction, (5) ground erosion, and (6) noise. Graphs of aircraft and engine performance under various flight conditions are included. Author

N74-20429 De Havilland Aircraft Co., Ltd., Downsview (Ontario). Advanced Research.
THE DEVELOPMENT OF AN INTEGRATED PROPULSION SYSTEM FOR JET STOL FLIGHT RESEARCH
J. A. Conway *In* AGARD V/STOL Propulsion Systems Jan. 1974 15 p refs (For availability see N74-20401 11-28)

The Augmentor-Wing powered lift concept provides the high lift required for STOL terminal operations by means of a cloce interrelationship between the propulsive and aerodynamic functions of the system. Therefore, the propulsion system is subject to more extensive design requirements than a conventional engine installation. Subsequent to extensive large scale model testing of the concept, general agreement was reached that flight research was feasible and desirable, but in view of the long development times and high costs involved, particularly in respect to engines, means would have to be found to utilize both existing engines and airframe. A de Havilland Buffalo airframe became the basis of the Augmentor-Wing flight research aircraft. The selection, modification and testing of the Rolls-Royce Spey 801 SF which became the basic power plant for the research aircraft are discussed. A description of the associated augmentor ducting is also given, together with an outline of the propulsion aspects of the first phases of testing. Author

N74-20430 Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
PROBLEMS OF V/STOL AIRCRAFT CONNECTED WITH THE PROPULSION SYSTEM AS EXPERIENCED ON THE Do 31 EXPERIMENTAL TRANSPORT AIRCRAFT
M. Lotz and P. Bartels *In* AGARD V/STOL Propulsion Systems Jan. 1974 12 p refs (For availability see N74-20401 11-28)

For V/STOL aircraft, the additional functions of the propulsion system cause some problems which do not occur on CTOL aircraft. As a consequence, the design and operation of V/STOL aircraft is more strongly influenced by propulsion-related problems. These problems are discussed based on the experience with the Do 31 jet lift transport. Hot gas reingestion largely determined the take-off technique adopted for the Do 31. Ground erosion of artificial and natural surfaces is discussed. The most important effects of jet interference in hover and transition are described. The lift engine air intakes have to provide very low thrust losses in hover, low distortion in transition and in-flight starting capability. Some aspects of hover flight control by differential thrust modulation, differential thrust vectoring and reaction control by bleed air are discussed. Finally, the influence of near field noise on the airframe structure and the possibilities of influencing community noise by exploiting the high operational flexibility of V/STOL aircraft are described. Author

N74-20431 Rolls-Royce, Ltd., Bristol (England). Engine Div.
PEGASUS ENGINE OPERATING EXPERIENCE IN THE HARRIER AIRCRAFT
R. J. Cant *In* AGARD V/STOL Propulsion Systems Jan. 1974 18 p (For availability see N74-20401 11-28)

The performance of the Pegasus engine installed in the Harrier aircraft is discussed. The special demands made on an engine for single engine V/STOL close combat application are explained. Operational experiences on the engine are analyzed to show the effects of: (1) the vectoring nozzle system, (2) bird strikes, (3) foreign object damage, (4) aircraft stabilizing, and (5) hot gas reingestion. Author

N74-20432 Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Bremen (West Germany).
THE DEVELOPMENT AND FLIGHT TESTING OF THE PROPULSION SYSTEM OF THE VAK 191 B V/STOL STRIKE AND RECONNAISSANCE AIRCRAFT
Klaus Wieland *In* AGARD V/STOL Propulsion Systems Jan. 1974 12 p (For availability see N74-20401 11-28)

The VAK 191 B has a mixed propulsion system comprising a main lift/cruise engine in the fuselage center and two lift engines installed in the front and the rear section of the fuselage. Bleed air is taken from each engine for aircraft attitude control. Design and development of the propulsion system including the control bleed system will be discussed. The type of control for the propulsion and bleed air system plays an important role towards achieving maximum performance. Extensive model testing has been done to investigate main and lift engine intake performance, lift engine relight capability and hot gas reingestion characteristics of the aircraft. The results have been proven in ground and flight testing. Full scale testing of the bleed air system has been carried out to derive steady state and dynamic characteristics. During ground and flight testing with three prototypes performance, handling and reliability of the propulsion system under VTOL and transition conditions were investigated.

Some special results and comparison with predictions are presented. Author

N74-20433 Advisory Group for Aerospace Research and Development, Paris (France).
TECHNICAL EVALUATION REPORT ON 42ND PROPULSION AND ENERGETICS PANEL MEETING ON V/STOL PROPULSION SYSTEMS
H. Grieb and N. A. Mitchell *In its* V/STOL Propulsion Systems Jan. 1974 7 p refs (For availability see N74-20401 11-28)

A technical evaluation of the conference on V/STOL propulsion systems is presented. Comments are prepared concerning the papers that were submitted and the round table discussions are summarized. Recommendations are submitted concerning the future course of actions to be taken for design and development of V/STOL aircraft and engines. The questions which were used as a guide line and the main points of discussion are briefly answered. P.N.F.

N74-20434*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPUTER PROGRAM FOR CALCULATING THE FLOW FIELD OF SUPERSONIC EJECTOR NOZZLES
Bernhard H. Anderson Washington Apr. 1974 89 p refs
(NASA-TN-D-7602; E-7476) Avail: NTIS HC $4.00 CSCL 21E

An analytical procedure for computing the performance of supersonic ejector nozzles is presented. This procedure includes real sonic line effects and an interaction analysis for the mixing process between the two streams. The procedure is programmed in FORTRAN 4 and has operated successfully on IBM 7094, IBM 360, CDC 6600, and Univac 1108. Author

N74-20435*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
STUDY OF CASING TREATMENT STALL MARGIN IMPROVEMENT PHENOMENA
D. C. Prince, Jr., D. C. Wisler, and D. E. Hilvers Mar. 1974 168 p refs
(Contract NAS3-15707)
(NASA-CR-134552; R73AEG326) Avail: NTIS HC$11.50 CSCL 21E

The results of a program of experimental and analytical research in casing treatments over axial compressor rotor blade tips are presented. Circumferential groove, axial-skewed slot, and blade angle slot treatments were tested. These yielded, for reduction in stalling flow and loss in peak efficiency, 5.8% and 0 points, 15.3% and 2.0 points, and 15.0% and 1.2 points, respectively. These values are consistent with other experience. The favorable stalling flow situations correlated well with observations of higher-then-normal surface pressures on the rotor blade pressure surfaces in the tip region, and with increased maximum diffusions on the suction surfaces. Annular wall pressure gradients, especially in the 50-75% chord region, are also increased and blade surface pressure loadings are shifted toward the trailing edge for treated configurations. Rotor blade wakes may be somewhat thinner in the presence of good treatments, particularly under operating conditions close to the baseline stall. Author

N74-20436*# Auburn Univ., Ala.
EXTENSION OF A SIMPLIFIED COMPUTER PROGRAM FOR ANALYSIS OF SOLID-PROPELLANT ROCKET MOTORS Final Report, 15 Dec. 1972 - 15 Apr. 1973
Richard H. Sforzini Apr. 1973 75 p refs
(Contracts NCA8-61S1-Mod-8; NCA8-61S2-Mod-9; NCA8-61S3-Mod-10)
(NASA-CR-129024) Avail: NTIS HC $6.75 CSCL 21H

A research project to develop a computer program for the preliminary design and performance analysis of solid propellant rocket engines is discussed. The following capabilities are included as computer program options: (1) treatment of wagon wheel cross sectional propellant configurations alone or in combination with circular perforated grains, (2) calculation of ignition transients with the igniter treated as a small rocket engine, (3) representation of spherical circular perforated grain ends as an alternative to the conical end surface approximation used in the original program, and (4) graphical presentation of program results using a digital plotter. Author

N74-20437*# Auburn Univ., Ala.
DESIGN AND PERFORMANCE ANALYSIS OF SOLID-PROPELLANT ROCKET MOTORS USING A SIMPLIFIED COMPUTER PROGRAM Final Report
Richard H. Sforzini Oct. 1972 120 p refs
(Contract NCA8-61-Mod-6)
(NASA-CR-129025) Avail: NTIS HC $9.00 CSCL 21H

An analysis and a computer program are presented which represent a compromise between the more sophisticated programs using precise burning geometric relations and the textbook type of solutions. The program requires approximately 900 computer cards including a set of 20 input data cards required for a typical problem. The computer operating time for a single configuration is approximately 1 minute and 30 seconds on the IBM 360 computer. About 1 minute and 15 seconds of the time is compilation time so that additional configurations input at the same time require approximately 15 seconds each. The program uses approximately 11,000 words on the IBM 360. The program is written in FORTRAN 4 and is readily adaptable for use on a number of different computers: IBM 7044, IBM 7094, and Univac 1108. Author

N74-20438# National Aerospace Lab., Tokyo (Japan).
ON LINEAR HEAT TRANSFER OF GAS TURBINE COMBUSTORS
Tetsuro Aiba Jul. 1973 40 p refs In JAPANESE; ENGLISH summary
(NAL-TR-327) Avail: NTIS HC $5.00

The recent trend of increasing pressure in aircraft gas turbine combustors results in much air being required for the film cooling of the combustor liners; and many studies on liner cooling have been carried out recently. The paper surveys the liner heat transfer of gas turbine combustors, mainly for aircraft. Studies are included on various ways of liner cooling and their characteristics, radiation heat transfer, film cooling and liner wall temperature. Actual cases are given of gas turbine combustors in each area, as well as the characteristic points of radiation heat transfer and film cooling related to the gas turbine combustors. Author

N74-20439# National Aerospace Lab., Tokyo (Japan).
EXPERIMENTAL INVESTIGATIONS ON A 5 cm MERCURY ELECTRON BOMBARDMENT ION ENGINE
Yoshihiro Nakamura, Hisao Azuma, and Katsuhiro Miyazaki Jul. 1973 22 p refs In JAPANESE; ENGLISH summary
(NAL-TR-326) Avail: NTIS HC $4.25

A 5 cm-diameter mercury electron bombardment ion engine with a filament type cathode was tested. As an accelerating system, screen-acclerator grids were employed. The effects of the variations of the parameters, such as flow rate of mercury, magnetic field strength, discharge voltage, discharge power and accelerating voltage, on the ion beam current were investigated. The mass utilization efficiency of the propellant is derived as a function of the ion production cost. The relations of ion beam current to accelerating voltage are normalized on the basis of the similarity law for ion flow. The characteristic curves are very close, but there are small differences between them. Probably these differences are caused by conditions in the discharge chamber. Glass as well as metal was used as a screen grid material. In case of the glass screen grid, the drain current becomes small at the lower accelerating voltage and the saturation of the beam current with the increase of the accelerating voltage is more gradual than in the case of the metal screen grid. Author

N74-20440*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ENDURANCE TESTING OF DOWNSTREAM CATHODES ON A LOW-POWER MPD THRUSTER
James A. Burkhart and James R. Rose Washington Apr. 1974 27 p refs
(NASA-TN-D-7616; E-7647) Avail: NTIS HC $3.25 CSCL 21C

A low-power MPD thruster with downstream cathode was tested for endurance with a series of hollow cathode designs. Failure modes and failure mechanisms were identified. A new hollow cathode (with rod inserts) has emerged which shows promise for long life. The downstream positioning of the cathode was also changed from an on-axis location to an off-axis location.

Data are presented for a 1332-hour life test of this new hollow cathode located at the new off-axis location. Xenon propellant was used. Author

N74-20441*# AiResearch Mfg. Co., Los Angeles, Calif.
HIGHTIP-SPEED, LOW-LOADING TRANSONIC FAN STAGE. PART 2: DATA COMPILATION
T. C. Ware, R. J. Kobayashi, and R. J. Jackson Feb. 1974 317 p
(Contract NAS3-13498)
(NASA-CR-121262; AiResearch-73-9487-Pt-2) Avail: NTIS HC $19.00 CSCL 21E

Tests were conducted on a high-tip-speed low-loading transonic fan stage to determine the performance and inlet flow distortion tolerance of the design. Test data were recorded for overall and blade element performance with both uniform and distorted inlet flows. A tabular summary of the data and a representative selection of the computer data reduction sheets are presented. Author

N74-20442*# AiResearch Mfg. Co., Los Angeles, Calif.
HIGH-TIP-SPEED, LOW-LOADING TRANSONIC FAN STAGE. PART 3: FINAL REPORT
T. C. Ware, R. J. Kobayashi, and R. J. Jackson Feb. 1974 200 p refs
(Contract NAS3-13498)
(NASA-CR-121263; AiResearch-73-9488-Pt-3) Avail: NTIS HC $13.00 CSCL 21E

Tests were conducted on a high-tip-speed, low-loading transonic fan stage to determine the performance and inlet flow distortion tolerance of the design. The fan was designed for high efficiency at a moderate pressure ratio by designing the hub section to operate at minimum loss when the tip operates with an oblique shock. The design objective was an efficiency of 86 percent at a pressure ratio of 1.5, a specific flow (flow per unit annulus area) of 42 lb/sec-sq. ft (205.1 kgm/sec-m sq), and a tip speed of 1600 ft/sec (488.6 m/sec). During testing, a peak efficiency of 84 percent was achieved at design speed and design specific flow. At the design speed and pressure ratio, the flow was 4 percent greater than design, efficiency was 81 percent, and a stall margin of 24 percent was obtained. The stall line was improved with hub radial distortion but was reduced when the stage was tested with tip radial and circumferential flow distortions. Blade-to-blade values of static pressures were measured over the rotor blade tips. Author

N74-20443# European Space Research Organization, Paris (France).
BEHAVIOUR OF THE TURBINE ENGINE
Feb. 1974 109 p Transl. into ENGLISH of "Verhalten des Turbotriebwerks", DGLR, Cologne, report DLR-Mitt-73-05, Jan. 1973 114 p Proc. of the DGLR Airbreathing Propulsion Comm. Meeting, Darmstadt, West Ger., 24 May 1972
(ESRO-TT-25; DLR-MITT-73-05) Avail: NTIS HC $8.50

The influence of combustion chambers, compressors, and afterburners, and their merchanical configuration, on the static performance of two-cycle turbojet engines, with a high bypass ratio was investigated. Some examples are given to show the influence of the variation of both nozzle surfaces and fuel throughout at given thrust on the parameters of the same engines without primary and secondary flow mixing. The performance of arbitrarily switched gas turbines was calculated by simulation with building block system on a digital computer. The effects of a party oil-filled converter for a turbine engine used to supply starting power to the main engines were investigated. For individual titles, see N74-20444 through N74-20447.

N74-20444 European Space Research Organization, Paris (France).
THE INFLUENCE OF INDIVIDUAL COMPONENTS AND OF THEIR MECHANICAL ARRANGEMENT ON THE STATIONARY OPERATING BEHAVIOUR OF DUAL CYCLE PROPULSION ENGINES
Hurbert Grieb *In its* Behaviour of the Turbine Engine Feb. 1974 p 4-45 Transl. into ENGLISH from "Verhalten des Turbotriebwerks", DGLR, Cologne, report DLR-Mitt-73-05, Jan. 1973 p 7-50 (For availability see N74-20443 11-28)

The influence of combustion chambers, compressors and afterburners, and their mechanical configuration, on the static performance of two-cycle turbojet engines with a high bypass ratio, was investigated. As a basis for comparison of the thermodynamic cycling processes, maximal thrust with and without afterburning at sea altitude and a flight Mach number of 0.9 were chosen. The following conclusions were drawn with regard to the type of engine investigated: (1) within certain limits, a desired performance can be obtained with several thermodynamic designs; (2) the influence of the mechanical configuration of the static performance is small; (3) the technological state-of-the-art of the components is essential for the quality of stationary operating characteristics; (4) the optimal turning of the compressor characteristics to the expected load lines has considerable influence on the operation; (5) the design of low pressure compressor transition to medium pressure compressor and (6) bypass channel needs special attention besides mechanical conception. ESRO

N74-20445 European Space Research Organization, Paris (France).
THE PERFORMANCE BEHAVIOUR OF A BYPASS ENGINE IN MULTIPARAMETER CONTROL
Heinrich Dissen *In its* Behaviour of the Turbine Engine Feb. 1974 p 49-66 Transl. into ENGLISH from "Verhalten des Turbotriebwerks", DGLR, Cologne, report DLR-Mitt-73-05, Jan. 1973 p 55-72 (For availability see N74-20443 11-28)

Some examples are given to show the influence of the variation of both nozzle surfaces and fuel throughout at given thrust and other boundary conditions on the engine parameters of a two-cycle turbojet engine with large bypass ratio without primary and secondary flow mixing. To this end, a computation method was developed for describing the performance of engines with multiparameter control. The advantages of multiparameter control are summarized. The disadvantages are: the system is more complicated, adjustable nozzles add to the engine weight, and accurate measurements are necessary for determining the engine parameters. ESRO

N74-20446 European Space Research Organization, Paris (France).
CALCULATION OF PERFORMANCE GRAPHS FOR GAS TURBINES WITH OPTIONAL CIRCUITS WITH A MODULAR ASSEMBLY SYSTEM BY MEANS OF A DIGITAL COMPUTER
Karl-Heinz Colling *In its* Behaviour of the Turbine Engine Feb. 1974 p 69-89 Transl. into ENGLISH from "Verhalten des Turbotriebwerks", DGLR, Cologne, Report DLR-Mitt-73-05, Jan. 1973 p 77-97 (For availability see N74-20443 11-28)

In order to determine the optimal component switching configuration of gas turbines, a method was developed to determine the performance characteristics, by simulating arbitrarily switched gas turbines using a building block system on a digital computer. The calculation is based on component characteristics and their theoretical flow models in a mathematical form. The turbine cycle process was split up into its components, for each of which a fixed program was written. With these component programs, every desirable circuit can be set up by connection in order of flow. This building block system is described, exemplified for a single and double shaft system, and the role of a correction program is indicated. ESRO

N74-20447 European Space Research Organization, Paris (France).
OBSERVATIONS ON PARTIAL FILL CONDITIONS OF A FLOW TRANSFORMER DURING THE STARTING PHASE
Friedrich Homola, Gottried Schwarz et al *In its* Behaviour of the Turbine Engine Feb. 1974 p 90-105 Transl. into ENGLISH from "Verhalten des Turbotriebwerks", DGLR, Cologne, Report DLR-Mitt-73-05, Jan. 1973 p 99-114 (For availability see N74-20443 11-28)

The effects of a partly oil-filled hydrodynamic converter for a single-shaft gas turbine, were investigated during the process of starting up the main engines. A converter is necessary to obtain a constant power supply. When electric power is extracted, the converter is filled with oil in order to gradually decrease power by energy dissipation during the starting process. Emptying takes place automatically after a certain time. As the acceleration processes take place only during 10 to 20 seconds, the filling

and emptying of the converter is of great importance. In particular, the effects of a partially filled converter were investigated. It was found that care must be taken in applying hydrodynamic converters. ESRO

N74-20448# Hughes Research Labs., Malibu, Calif.
ADVANCED ION SOURCE Final Report, 21 Mar. - 21 Jun. 1973
Harry J. King 21 Mar. 1973 59 p refs
(Contract F08606-73-C-0038; ARPA Order 1702)
(AD-772833) Avail: NTIS CSCL 21/3

The analytic and experimental studies conducted during Phase 1 of the program indicate that it is possible to design both cesium and iodine sources to meet the specified brightness requirements of 200 and 100 A/cm squared sr respectively. No reasons were uncovered as to why these two types of sources cannot operate in the same vacuum environment in such a manner that the ion species available to the AMS can be rapidly changed. Prototype hardware will be developed in Phase 2 to demonstrate this ability. Author (GRA)

N74-20449# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium). Turbomachinery Lab.
THE LOW HUB-TIP RATIO SUPERSONIC AXIAL-FLOW COMPRESSOR, VOLUME 4 Final Report, 1 Jul. 1971 - 30 Jun. 1972
Frans A. E. Breugelmans Jun. 1973 55 p refs
(Grant AF-AFOSR-2104-71; AF Proj. 7065)
(AD-773352; VKI-IN-45-Vol-4; ARL-73-0190) Avail: NTIS CSCL 21/5

The report describes the overall and detail performance of the Mach 2 supersonic rotor at 70%, 84%, 90% and 100% of the design speed. Author (GRA)

N74-20450# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MIXING OF GAS AND AIR JETS IN JET ENGINES
A. Hartmann 19 Dec. 1973 17 p refs Transl. into ENGLISH from Z. Flugwiss. (West Germany), v. 19, no. 4, Apr. 1971 p 158-163
(AD-773908; FTD-HC-23-478-74) Avail: NTIS CSCL 21/5

At the current state of engine development, an improvement in specific consumption or an increase in thrust concentration can be obtained only with relatively great effort, e.g. by improving partial efficiencies and increasing the turbine inlet temperature by using better blade materials and introducing more efficient cooling techniques. Jet mixing is a relatively simple matter and results in a remarkable improvement in efficiency. By means of the gas-dynamic energy transport in jet engines, the noise of the discharged gas jets can be abated. (Modified author abstract) GRA

N74-20451# Colt Industries, Inc., West Hartford, Conn. Chandler Evans Control Systems Div.
ADVANCED ENGINE CONTROL PROGRAM Final Report
R. J. Hearn, M. A. Cole, and A. H. White Nov. 1973 96 p refs
(Contract DAAJ02-72-C-0084; DA Proj. 1G1-62207-AA-71)
(AD-773660; R-492-45; USAAMRDL-TR-73-81) Avail: NTIS CSCL 21/5

Development of electronic control and centrifugal pump technology for use in future small turboshaft engines is reported. Redesign of the electronic computer using micropowered analog and digital components has resulted in a reduction in electrical power dissipation from 60 to about 7 watts, which virtually eliminates self heating problems. Supply voltage and noise sensitivities have also been substantially reduced. The induced vibration has been limited to less than 30 g's over the complete vibration spectrum. Increasing the pump speed from 37,500 to 55,000 rpm to reduce disc friction has resulted in a 50% reduction in the fuel temperature rise. (Modified author abstract) GRA

N74-20452# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CHARACTERISTICS OF CASCADES OF SLOTTED SECTIONS OF ADJUSTABLE GUIDE VANES OF AXIAL-FLOW TURBINES
Yu. S. Kustarev 17 Jan. 1974 14 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Mashinostr. (Moscow), no. 12, 1971 p 88-92
(AD-773900; FTD-HT-23-777-74) Avail: NTIS CSCL 21E

The report deals with the aerodynamic characteristics of foil lattices of slotted sections, developed for adjustable guide vanes of vehicle gas-turbine engines. A close coincidence was observed between the aerodynamic indicators of slotted and nonslotted foil lattices. GRA

N74-20453# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROBLEM OF THE APPLICATION OF TURBOFAN ENGINES IN AIR TRANSPORT. METHODS OF INCREASE IN EFFICIENCY OF TURBOFAN ENGINE WITH HIGH BYPASS RATIOS
A. L. Klyachkina 28 Nov. 1973 158 p refs Transl. into ENGLISH from Tr. Rizhskii Inst. inzh. Gradzhanskoi Aviatsii (USSR), no. 174, 1971 p 1-153
(AD-773292; FTD-MT-24-661-73) Avail: NTIS CSCL 21/5

The report contains Soviet generated articles relative to the operating parameters of gas turbine engines, thermodynamic functions, gas dynamics, and acoustic characteristics. GRA

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear.

N74-20454 California Univ., San Diego.
QUASILINEAR SPECTRUM OF LONGITUDINAL PROTON CYCLOTRON WAVES DRIVEN BY THERMAL GRADIENT EFFECTS ON THE SOLAR WIND Ph.D. Thesis
Robert Walter Harvey 1973 164 p
Avail: Univ. Microfilms Order No. 74-2379

Longitudinal proton cyclotron waves are studied as a possible explanation for solar wind observations of an enhancement of the power spectrum of electron density irregularities at spatial scales the order of several ion gyroradii. These waves may be excited by the effective electron current associated with thermal conduction effects in the interplanetary plasma. Using quasilinear theory and including Coulomb collision effects, a quasistationary spectrum of these waves is found for two cases: (1) quasilinear relaxation of the electrons but a bi-Maxwellian distribution for the protons; and (2) quasilinear relaxation of both the electron and proton distributions. Dissert. Abstr.

N74-20455 Catholic Univ. of America, Washington, D.C.
ROTATIONAL BURSTING OF SMALL CELESTIAL BODIES: EFFECTS OF RADIATION PRESSURE Ph.D. Thesis
Stephen Joseph Paddack 1973 223 p
Avail: Univ. Microfilms Order No. 74-3503

A mechanism and experimental results are presented that can be used to explain the sparsity of population of sporadic meteoroids and micrometeoroids relative to the amount of particles that would be expected from the dissolution of meteor streams. The mechanism applies equally well to lunar ejecta, tektites in particular, which might be sent into orbit around the sun. It will be shown that this theory helps to understand why tektites appear in dense strewn fields in various places on the earth rather than randomly distributed. This experimentation yields qualitative and quantitative answers to some of the problems of the elimination of meteors and tektites from the solar system. An unexpected result of the experiment, is an effect which may result from the absorption and reradiation of energy by arbitrarily shaped bodies. The effect was always seen to cause an effective increase in the rate of rotation whichever the initial direction of rotation. This same effect is seen to cause a tektite in oscillation to be negatively damped and eventually to rotate with increasing speed. Dissert. Abstr.

N74-20456*# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
STUDY OF HELIUM EMISSIONS FROM ACTIVE SOLAR REGIONS Final Summary Report

J. L. Kulander Oct. 1973 174 p refs
(Contract NAS8-27988)
(NASA-CR-120174; LMSC-D354991) Avail: NTIS HC $11.75 CSCL 03B

A theoretical study is made of the visible and UV line radiation of He I atoms and He II ions from a plane-parallel model flare layer. Codes were developed for the solution of the statistically steady state equation for a 30 level He I - II - III model, and the line and continuum transport equations. These codes are described and documented in the report along with sample solutions. Optical depths and some line intensities are presented for a 1000 km thick layer. Solutions of the steady state equations are presented for electron temperatures 10,000 to 50,000 K and electron densities 10 to the 10th power to 10 to the 14th power/cu cm. Author

N74-20457*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
INVESTIGATION OF GAMMA RAYS FROM THE GALACTIC CENTER Final Report
Henry F. Helmken Nov. 1973 15 p refs
(Grant NGR-09-015-173)
(Rept-311-014; NASA-CR-137384) Avail: NTIS HC $4.00 CSCL 03B

Data from Argentine balloon flights made to investigate gamma ray emission from the galactic center are summarized. Data are also summarized from a Palestine, Texas balloon flight to measure gamma rays from NP 0532 and Crab Nebulae. Author

N74-20458*# Techtran Corp., Glen Burnie, Md.
THE GENERATION OF NUCLEI OF COSMIC RAYS OF SOLAR ORIGIN
S. S. Konyakhina, L. V. Kurnosova, V. I. Logachev, L. A. Razorenov, V. G. Sinitsina, and M. I. Fradkin Washington NASA Nov. 1973 7 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Fiz. (Moscow), v. 35, no. 12, 1971 p 2446-2447
(Contract NASw-2485)
(NASA-TT-F-14773) Avail: NTIS HC $4.00 CSCL 03B

A brief treatment is presented of some observations of solar activity and heavy nuclei believed to be of solar origin and observed during the flights of the Elektron series satellites. There is some discussion of the possibility that the two previously mentioned phenomena are coincidental and an example arguing in favor of the opposite view, that there is no particular basis for linking the two. Author

N74-20459*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR WIND DATA FROM THE MIT PLASMA EXPERIMENTS ON PIONEER 6 AND PIONEER 7
A. J. Lazarus (MIT, Cambridge), M. A. Heinemann (MIT, Cambridge), R. W. McKinnis (MIT, Cambridge), and H. S. Bridge (MIT, Cambridge) Jun. 1973 415 p Prepared by MIT, Cambridge
(Contract NAS2-3793)
(NASA-TM-X-69991; NSSDC-73-08) Avail: NTIS HC $23.75 CSCL 03B

Hourly averages are presented of solar wind proton parameters obtained from experiments on the Pioneer 6 and Pioneer 7 spacecraft during the period December 16, 1965 to August 1971. The number of data points available on a given day depends upon the spacecraft-earth distance, the telemetry bit rate, and the ground tracking time allotted to each spacecraft. Thus, the data obtained earlier in the life of each spacecraft are more complete. The solar wind parameters are given in the form of plots and listings. Trajectory information is also given along with a detailed description of the analysis procedures used to extract plasma parameters from the measured data. Author

N74-20460# Central Research Inst. for Physics, Budapest (Hungary).
SPATIAL DISTRIBUTION OF CHARGED PARTICLES BENEATH THE RADIATION BELTS AS MEASURED ON BOARD OF THE SATELLITE INTERCOSMOS-3
M. Bano (Slovak Acad. of Sci., Kosice), J. Dubinsky (Slovak Acad. of Sci., Kosice), S. Fischer (Czechoslovak Acad. of Sci., Ondrejov), T. Gombosi, N. L. Grigorov (Moscow State Univ.), A. Holba, S. N. Kuznetsov (Moscow State Univ.), V. A. Kuznetsova (Moscow State Univ.), V. N. Lutsenko (Acad. Sci. (USSR), Moscow), S. Pinter (Slovak Acad. Sci., Hurbanova) et al Jun. 1973 22 p refs Presented at the 16th Plenary Meeting of COSPAR, Konstanz, 1973
(KFKI-73-30) Avail: AEC Depository Libraries HC $3.00

Properties of charged particle fluxes observed under the radiation belts up to shells L=3 are described. In these regions, a storing process of dissipated electrons with energies E sub e > 40 keV is operating continuously and leads to a characteristic longitude dependence of the intensity of dissipated electrons. It is shown that, as the electrons are drifting round the earth, the majority of them die out in the region of the Brazilian anomaly, where their trajectories merge into the atmosphere. Summarized and averaged data measured during the violent geomagnetic storm of Oct. 17, 1970 and immediately after it, during a time of moderate geomagnetic disturbance Oct. 19, 1970, are given. The intensity of dissipated electrons is observed to increase with increasing storm parameter. Intensities of penetrating particles (cosmic rays and their secondaries) are given as function of L. Author (NSA)

N74-20461# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
VARIABILITY OF INTENSITY RATIOS OF H TO He AND He.TO Z EQUAL TO OR GREATER THAN 3 IONS IN SOLAR ENERGETIC PARTICLE EVENTS Progress Report
J. A. VanAllen, P. Venkatarangan (Natl. Res. Council), and D. Venkatesan (Calgary Univ.) 28 Sep. 1973 11 p refs Repr. from Journal of Geophys. Res., v. 79, no. 1, 1 Jan. 1974 p 1-8
(Contract N00014-68-A-0196-0003)
(AD-773470; U-of-Iowa-73-34) Avail: NTIS CSCL 03/2

By means of data from the University of Iowa solid state detector on Explorer 35, a study has been made of the intensity ratios of H to He and He to ions with atomic numbers greater than or equal to 3 in the sub-MeV per nucleon specific kinetic energy range for various periods in 1968 and 1969. The principle finding is that the intensity ratios vary markedly from event to event and more especially during the time history of individual events. The ratios have no simple relationship to solar abundance in the usual sense of that term. The interpetation of the event is that differential diffusion of the various ionic species with differing magnetic rigidities is the dominant physical cause of observed variabilities. The evidence favors the hypothesis that ions with atomic numbers greater than or equal to 3 in the sub-MeV per nucleon energy range are less than completely ionized. Author

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N74-20462 Pennsylvania State Univ., University Park.
CREEP RESPONSE OF THE LUNAR CRUST IN MARE REGIONS FROM AN ANALYSIS OF CRATER DEFORMATION Ph.D. Thesis
Adolf Wilhelm Gerhard Kunze 1973 149 p
Avail: Univ. Microfilms Order No. 74-4259

The settling trends of 318 lunar mare craters ranging in size from 4 km to 25 km are compared with numerical settling simulations of finite element models in order to determine the creep response of the upper lunar mare crust. In order to estimate crater relief (height to diameter ratio) as a function of time, crater ages were obtained based on counts of superimposed inpact pits of diameters of 400 m or greater visible on Lunar Orbiter photographs, assuming a constant meteoritic flux during the last 3.5 billion years. Least squares analysis of the resulting settling trends indicates a systematic increase in the settling rates with increasing diameter in a manner suggesting nonlinearity in the lunar creep response. No settling is evident in craters smaller than 5 km in diameter. Comparison of the observed

settling trends with those calculated using viscous finite element crater models indicates that the lunar creep response in the mare regions is best represented by the creep power law. Dissert. Abstr.

N74-20463+ Ohio State Univ., Columbus. Radio Observatory.
OSURO CATALOG OF SOURCE LISTS AND PUBLICATIONS
1 Jan. 1974 14 p
Avail: NTIS HC $4.00

A catalog listing radio spectra, radio sources and optical identification of those sources, and nonstellar optical objects is provided. Data are also provided on sky maps. E.H.W.

N74-20464 Virginia Univ., Charlottesville.
OBSERVATIONS OF DOUBLE AND MULTIPLE STELLAR SYSTEMS MADE WITH THE ASTROMETRIC MULTIPLEXING AREA SCANNER Ph.D. Thesis
Charles Ditto Smith 1973 176 p
Avail: Univ. Microfilms Order No. 73-31166

The astrometric multiplexing area scanner is an instrument designed to measure the positions and magnitude of a number of stars in a field having a diameter of a few minutes of arc. Light from the stars in the field is modulated by a rotating Ronchi grating and detected by a photomultiplier tube. The amplified, digitized signal is stored in a multichannel analyzer and is used to reconstruct the positions and magnitudes of the stars in the field. Analysis of the H-R diagram plotted using measured stellar magnitudes confirms evolutionary effects for primary stars in binary systems as previously noted in the literature, but for pairs whose separation is too small for conventional photoelectric methods. Dissert. Abstr.

N74-20465 New York Univ., N.Y.
DYNAMICAL INSTABILITY IN DENSE HELIUM WHITE DWARFS Ph.D. Thesis
Lorraine Eva Whitman 1973 141 p
Avail: Univ. Microfilms Order No. 74-1984

The ways by which low mass stars might evolve into the highly collapsed states required to explain pulsar behavior are discussed. In particular, the dynamical behavior of cold, dense helium white dwarfs near the Chandrasekhar mass limit, 1.4 solar masses, are examined as they are destabilized by a gamma = 4/3 relativistic effect and by the onset of inverse beta decay. The periods of oscillation of stable white dwarfs, the central density at which helium white dwarfs become unstable to infinitesimal perturbations, and the e-folding times of the linearly unstable configurations are obtained using standard variational techniques applied to the linearized post-Newtonian relativistic equation of motion. A Fermi gas equation and radial symmetry have been assumed. The results are compared to previous investigations. Variational forms for the fundamental radial modes of the linear oscillations of the white dwarfs are given and their significance discussed. Dissert. Abstr.

N74-20466 Case Western Reserve Univ., Cleveland, Ohio.
BALMER LINE AND CONTINUUM EMISSION IN EARLY B STARS Ph.D. Thesis
Nelson James Irvine 1973 56 p
Avail: Univ. Microfilms Order No. 74-2530

An examination of the spectra of 75 stars noted as ce in the LS (luminous star) catalogues leads to the conclusion that this designation is meaningless for O stars and stars more luminous than class III. The confirmed ce stars are confined almost exclusively to the range B0 - B2 III - Ve. Measures of the strength of the line and continuum emission for the LS stars and a number of brighter Be stars demonstrate that the ce strength is related to the strength of the line emission and to the steepness of the Balmer emission decrement. It does not appear to be related to the projected rotational velocity. Collected observations of the equivalent widths of the hydrogen lines in Be stars show that those stars with the strongest Ha emission tend to have either high or very low projected rotational velocities. For individual stars there is a correlation between the Balmer emission decrement and the strength of the Ha emission. Dissert. Abstr.

N74-20467*# California Univ., La Jolla.
[STUDIES OF THE STRUCTURE OF THE PLASMASPHERE AS SEEN BY RADIOSOUNDER MEASUREMENTS ABOARD THE ALOVETTI-SATELLITE] Final Technical Report
P. M. Banks and J. R. Doupnik 13 Nov. 1973 74 p refs
(Grant NGR-05-009-180)
(NASA-CR-137371) Avail: NTIS HC $6.75 CSCL 03B

The structure of the plasmasphere was studied as seen by radiosounder measurements aboard the Alovetti-2 satellite. Magnetic tape data files were obtained from the NASA Ames Research Center to give a reasonably complete set of high latitude electron density profiles. Considerable effort was expended to develop models of ion flow in the topside ionosphere. These models took both H(+) and O(+) into account and permitted various parameter studies to be made of the various factors which affect H(+) escape in polar wind flows. The results of these studies are included. Extensive computer programs were written to display the measured electron density profiles in ways useful to geophysical analysis. The expected mid-latitude trough was easily discernable in the nightime ionosphere at locations expected from similar observations of the plasmapause. In the dayside ionosphere, however, it proved extremely difficult to find any trough-like phenomena. Using the previously developed computer models, it was possible to study the region where the plasmapause appeared to be absent. It was found that over much of the dayside, large fluxes were computed well inside the plasmapause extending down to L-shells as low as 2.5.
Author

N74-20468*# SCI Electronics, Inc., Huntsville, Ala.
A SATURN LAUNCHED X-RAY ASTRONOMY EXPERIMENT. VOLUME 1: S-027 Final Program Report
11 Mar. 1971 90 p
(Contract NAS8-21015)
(NASA-CR-120166) Avail: NTIS HC $7.50 CSCL 03A

The S-027 X-Ray Astronomy Experiment originally proposed in early 1966, was developed to detect X-rays in the 2 keV to 10 keV range. Both a prototype unit and flight unit were constructed with the prototype unit also serving as the engineering model, the qualification test unit, and after refurbishment, as the back-up flight unit. Two Ground Support Equipment consoles were built to verify the experiment operation. A photograph of one experiment package with its Ground Support Equipment is shown. The S-027 experiment was scheduled for launch in 1968/69 and although both units were completed and tested to the extent that either would be ready for the scheduled launch, delays in the space program resulted in a launch date slip of several years. When the 1968/69 launch delay became official, provisions were made for storage of the two experiment packages at SCI Electronics in Huntsville, Alabama until a new launch date could be established. Author

N74-20469*# Lowell Observatory, Flagstaff, Ariz.
RESULTS OF CURRENT MARS STUDIES AT THE IAU PLANETARY RESEARCH CENTER
William A. Baum 3 Jan. 1974 17 p refs
(Grant NGR-03-003-007)
(NASA-CR-138007) Avail: NTIS HC $4.00 CSCL 03B

Ground based images obtained hourly by seven observatories are used to study Martian phenomena. Maps of global dust storms show the degree of activity of the storm depends both on the region and on the time of day. Statistical analysis of regional contrast variations on the images supports the opinion that the contrasts in the brightness of the light and dark areas depends on the Martian season. Residual differences may be due to a phase angle dependence. Diagrams confirm the earlier finding that there is a systematic trend of regional contrast with the time of the Martian day and that the afternoon is not symmetric with the morning. The dissipation of Martian polar caps is also discussed. K.M.M.

N74-20470*# Cornell Univ., Ithaca, N.Y. Dept. of Chemistry.
TRACE GEOCHEMISTRY OF LUNAR MATERIAL Final Report
George H. Morrison 31 Jan. 1974 12 p refs
(Grant NGR-33-010-166)
(NASA-CR-137386) Avail: NTIS HC $4.00 CSCL 03B

The lunar samples from the Apollo 16 and 17 flights which

were analyzed include soil, igneous rock, anorthositic gabbro, orange soil, subfloor basalt, and norite breccia. Up to 57 elements including majors, minors, rare earths and other trace elements were determined in the lunar samples. The analytical techniques used were spark source mass spectrometry and neutron activation analysis. The latter was done either instrumentally or with group radiochemical separations. The differences in abundances of the elements in lunar soils at the various sites are discussed. With regard to the major elements only Si is about the same at all the sites. A detailed analysis which was performed on a sample of the Allende meteorite is summarized. Author

N74-20471*# Dudley Observatory, Albany, N.Y.
ASTRONOMICAL ACTIVITIES OF THE APOLLO ORBITAL SCIENCE PHOTOGRAPHIC TEAM Final Technical Report
Robert D. Mercer 31 Jan. 1974 89 p
(Grant NGR-33-011-031)
(NASA-CR-137376) Avail: NTIS HC $7.50 CSCL 03A

A partial accounting of Apollo Orbital Science Photographic Team (APST) work is presented as reported by one of its members who provided scientific recommendations for, guidance in, and reviews of photography in astronomy. Background on the formation of the team and its functions and management are discussed. It is concluded that the APST clearly performed the overall objective for which it was established - to improve the scientific value of the Apollo lunar missions. Specific reasons for this success are given. Author

N74-20472*# Toledo Univ., Ohio. Ritter Astrophysical Research Center.
A SEARCH FOR CONTINUOUS FLUORESCENCE IN REFLECTION NEBULAE
William F. Rush and Adolf N. Witt [1973] 30 p refs
(Grant NGR-36-010-016)
(NASA-CR-138029) Avail: NTIS HC $4.50 CSCL 03A

Photometric and spectrophotometric observations were made of the reflection nebulae NGC1435, NGC2068, NGC7023, and IC1287 in an attempt to detect continuous fluorescence by dust grains. Several effects of importance for observations of such faint objects are discussed, including instrumental light scattering, a photographic effect, and a time delay effect which can occur if the illuminating star is a spectrum variable. It is found that continuous fluorescence by interstellar grains is not likely to exist and that it cannot account for more than 10 percent of the total surface brightness of these reflection nebulae. No evidence of diffuse interstellar features is found in the spectra of these nebulae. Author

N74-20473# Manchester Univ. (England).
JODRELL BANK ANNALS, SERIES 1, VOLUME 2, PART 1
Sep. 1973 211 p refs
Avail: NTIS HC $13.75

A versatile interferometer was used to measure angular sizes of radio sources. Angular structures of radio sources at 24 km baseline were also observed using the Parkes and 3C catalogues. For individual titles, see N74-20474 through N74-20477.

N74-20474 Manchester Univ. (England).
A VERSATILE INTERFEROMETER FOR MEASURING THE ANGULAR SIZES OF RADIO SOURCES USING BASELINES OF A FEW TENS OF KILOMETERS
B. Rowson *In its* Jodrell Bank Ann., Ser. 1, Vol. 2, Pt. 1 Sep. 1973 p 2-17 refs (For availability see N74-20473 11-30)

An interferometer is described which uses radio links to bring the information from the remote aerial to the home station for correlation. It is therefore best used on baselines of lengths between 10 and 100 kms. It was used for observations on 151, 408, 611, 1423, and 1660 MHz and certain pairs of these frequencies simultaneously. The design is such as to minimize the amount of equipment which is different for these observing frequencies. Because of this versatility and because of the effects of the earth's atmosphere, no attempt was made to preserve the absolute phase of the fringes, and so the instrument is best suited to measurements of angular size and some simple features of source structure. Author

N74-20475 Manchester Univ. (England).
OBSERVATIONS OF RADIO SOURCES WITH AN INTERFEROMETER OF 24 km BASELINE. 1. THE ANGULAR STRUCTURES AT 408 MHz OF 106 SOURCES FROM THE PARKES CATALOGUE
J. Critchley, H. P. Palmer, and B. Rowson *In its* Jodrell Bank Ann., Ser. 1, Vol. 2, Pt. 1 Sep. 1973 p 18-35 refs (For availability see N74-20473 11-30)

Angular size and structure information at 408 MHz on 106 sources from the Parkes catalogue in the range -13 deg < delta < -17 deg is presented. The data show that there is a larger fraction of double sources consisting of compact widely separated emitting regions. Author

N74-20476 Manchester Univ. (England).
OBSERVATIONS OF RADIO SOURCES WITH AN INTERFEROMETER OF 24 km BASELINE. 2. THE ANGULAR STRUCTURE AT 151 AND 408 MHz OF 46 UNIDENTIFIED RADIO SOURCES FROM THE REVISED 3C CATALOGUE
P. K. Wraith *In its* Jodrell Bank Ann., Ser. 1, Vol. 2, Pt. 1 Sep. 1973 p 36-53 refs (For availability see N74-20473 11-30)

The angular structures of 46 unidentified radio sources from the revized 3C catalogue were determined with the MK 1 - MK 3 interferometer. The observations were made at 151 and 408 MHz simultaneously giving maximum resolving powers of approximately 4 arcsec and approximately 1.2 arcsec respectively. Many of the sources have a double structure; the components of these double sources often have higher brightness regions toward their outer edges and lower brightness tails usually pointing toward the centroid of the source. Only a few of the components in any of the sources were resolved perpendicular to their direction of elongation. Author

N74-20477 Manchester Univ. (England).
OBSERVATIONS OF RADIO SOURCES WITH AN INTERFEROMETER OF 24 km BASELINE. 3. THE ANGULAR STRUCTURES AT 408 AND 1423 MHz OF 44 RELATIVELY INTENSE RADIO SOURCES
P. N. Wilkinson *In its* Jodrell Bank Ann., Ser. 1, Vol. 2, Pt. 1 Sep. 1973 p 58-78 refs (For availability see N74-20473 11-30)

The results of long baseline radio interferometer studies at 408 and 1423 MHz of the angular structures of a sample of relatively intense radio sources, mainly from the 3CR catalogue, are presented. The MK 1 - MK 3 interferometer was used. Four sources not satisfying selection criteria were observed. The results of the model fitting analysis of the visibility data are given and discussed for each source, and some of the more interesting points arising from them noted. Author

N74-20478*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE ATMOSPHERE OF TITAN
Donald M. Hunten, ed. Washington 1974 185 p refs Workshop held at Moffett Field, Calif., 25-27 Jul. 1973
(NASA-SP-340) Avail: NTIS HC $5.50 CSCL 03B

Spectroscopic and radiometric observations are used to form models for the Titan atmospheric composition and circulation. For individual titles, see N74-20479 through N74-20497.

N74-20479* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
RANGE OF ENGINEERING VARIABLES
In its The Atmos. of Titan 1974 p 1-3 (For availability see N74-20478 11-30)
CSCL 03B

Titan is the largest satellite of Saturn. Its probable structure includes a possible ice crust and a massive atmosphere that far outweights those of other satellites of the outer planets. Possible atmospheric compositions compatible with spectroscopic data contain methane abundances, hydrogen atoms, and nitrogen.
G.G.

N74-20480* Kitt Peak National Observatory, Tucson, Ariz.
SCIENTIFIC SUMMARY
D. M. Hunten *In* NASA. Ames Res. Center The Atmos. of Titan 1974 p 4-8 (For availability see N74-20478 11-30)
CSCL 03B

Methane absorptions are prominent in the Titan atmospheric

spectrum; also present are atomic hydrogen and nitrogen bands. Evaluation of the low ultraviolet albedo points to solid methane clouds and photochemical haze. Thermal infrared data indicate solar energy absorption and photodissociation reactions of the gas mixture resulting in the production of organic compounds and free hydrogen atoms. G.G.

N74-20481* Hawaii Univ., Honolulu.
RADIUS AND MASS OF TITAN
D. Morrison *In* NASA. Ames Res. Center The Atmos. of Titan 1974 p 9-11 ref (For availability see N74-20478 11-30)
CSCL 03B

A Titan radius of 2500 km and its corresponding mass are used to determine Titan density at 2.1 plus or minus 0.6 g cm to the minus 3 power acceleration and gravity at the surface as 145 plus or minus 30 cm s/2. G.G.

N74-20482* Hawaii Univ., Honolulu.
INFRARED PHOTOMETRY AND SPECTROPHOTOMETRY OF TITAN
D. Morrison *In* NASA. Ames Res. Center The Atmos. of Titan 1974 p 12-16 refs (For availability see N74-20478 11-30)
CSCL 03B

The wide variation in infrared brightness temperature of Titan is explained in terms of a greenhouse effect. Radiometric observations in the infrared and microwave frequencies indicate an alternate hot atmospheric model. Methane, ammonia, hydrogen atoms, and nitrogen atoms are suggested as main constituents for the Titan atmosphere. G.G.

N74-20483* Texas Univ., Austin.
TITAN'S SPECTRUM AND ATMOSPHERIC COMPOSITION
L. M. Trafton *In* NASA. Ames Res. Center The Atmos. of Titan 1974 p 17-41 refs (For availability see N74-20478 11-30)
CSCL 03B

Spectroscopic evidence shows that hydrogen atoms are major constituents of Titan's atmosphere. Anomalous enhancement of the methane absorption band is attributed to isotopic shifts arising from methane photolysis. Anomalous ultraviolet absorption features suggest high altitude dust and an elevated cloud layer overlaying most of the methane in the atmosphere. G.G.

N74-20484* Cornell Univ., Ithaca, N.Y.
PHOTOMETRY AND POLARIMETRY
J. Veverka *In* NASA. Ames Res. Center The Atmos. of Titan 1974 p 43-57 refs (For availability see N74-20478 11-30)
CSCL 03B

A review of available information on the photometry, polarimetry, and narrow band spectrophotometry of Titan discusses five major categories: (1) brightness and color as a function of orbital position; (2) brightness and color as a function of solar phase angle; (3) geometric and bond albedo; (4) reflectance as a function of wavelength; and (5) polarization as a function of solar phase angle. It is concluded that a Saturn-like cloud model may be required to explain the sum of polarimetric and photometric observations. Author

N74-20485* Massachusetts Inst. of Tech., Cambridge.
INTERIOR AND ITS IMPLICATIONS FOR THE ATMOSPHERE
J. S. Lewis *In* NASA. Ames Res. Center The Atmos. of Titan 1974 p 58-71 ref (For availability see N74-20478 11-30)
CSCL 03B

The bulk composition and interior structure of Titan required to explain the presence of a substantial methane atmosphere are shown to imply the presence of solid CH4 - 7H2O in Titan's primitive material. Consideration of the possible composition and structure of the present atmosphere shows plausible grounds for considering models with total atmospheric pressures ranging from approximately 20 mb up to approximately 1 kb. Expectations regarding the physical state of the surface and its chemical composition are strongly conditioned by the mass of atmosphere believed to be present. A surface of solid CH4, liquid CH4 solid, CH4 hydrate, H2O ice, aqueous NH3 solution, or even a non-surface of supercritical H2O-NH3-CH4 fluid could be rationalized. Author

N74-20486* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MODELS OF TEMPERATURE STRUCTURE AND GENERAL CIRCULATION
J. B. Pollack *In its* The Atmos. of Titan 1974 p 72-87 refs (For availability see N74-20478 11-30)
CSCL 03B

Titan has a warm upper atmosphere. Whether it has a warm lower atmosphere and hot surface is an open question. This question is important not only from a purely scientific point of view, but also for assessing the viability of a Titan entry probe. Author

N74-20487* Princeton Univ., N.J.
ULTRAVIOLET OBSERVATIONS OF TITAN FROM OAO-2
J. J. Caldwell *In* NASA. Ames Res. Center The Atmos. of Titan 1974 p 88-91 refs (For availability see N74-20478 11-30)
CSCL 03B

High altitude deposition of energy in Titan's atmosphere can have a significant effect on the spectral distribution of emitted thermal radiation from the satellite. This reasoning led to the prediction of emission peaks at wavelengths corresponding to allowed bands of CH4 and trace photolysis products such as C2H6. Intermediate resolution infrared spectrophotometry has encouraged this interpretation of the infrared properties of Titan, and provided the basis for initial, detailed model. Author

N74-20488* Princeton Univ., N.J.
AN INVERSION IN THE ATMOSPHERE OF TITAN
R. E. Danielson, J. J. Caldwell, and D. R. Larach *In* NASA. Ames Res. Center The Atmos. of Titan 1974 p 92-109 refs Repr. from Icarus, v. 20 (For availability see N74-20478 11-30)
CSCL 03B

A very detailed greenhouse model derives a methane to hydrogen ratio of unity and a minimum surface pressure of 0.4 atm. Based on a surface gravity g = 140 cm sec/2, the minimum CH4 abundance is 30-40 km-A and the minimum H2 abundance varies from 15 to 85 km-A. A model of the atmosphere of Titan is proposed which seems to be consistent with observations and requires a much smaller CH4 abundance (of the order or 2 km-atm). Although no H2 is required, the presence of some H2 is readily accommodated. In this model, a temperature inversion exists in the atmosphere due to absorption of blue and ultraviolet solar radiation by small particles. The absorbed radiation is re-radiated by the dust and by molecules having long wavelength bands such as CH4 7.7 micrometer and ethane at 12.2 micrometer. The brightness temperature at 20 micrometer is primarily due to re-radiation by the dust. Author

N74-20489* Kitt Peak National Observatory, Tucson, Ariz.
BLOWOFF AND ESCAPE OF H2
D. M. Hunten *In* NASA. Ames Res. Center The Atmos. of Titan 1974 p 110-117 refs (For availability see N74-20478 11-30)
CSCL 03B

It is shown that a pure hydrogen atmosphere cannot be retained by Titan, but will blow off in a few hours. Addition of a heavier gas, such as CH4 or N2, in comparable abundance gives a great improvement, although the escape rate can still be large. Moreover, the actual flux can be predicted with confidence from the mixing ratio of H2 to heavy gas. Author

N74-20490* Cornell Univ., Ithaca, N.Y.
GASEOUS TOROID AROUND SATURN
Thomas R. McDonough *In* NASA. Ames Res. Center The Atmos. of Titan 1974 p 118-122 refs (For availability see N74-20478 11-30)
CSCL 03B

The trapping of Titan's escaping atmosphere in the Saturnian system by a toroidal ring is discussed. The radius of the toroid is comparable to Titan's orbit, or about ten times larger than the visible rings. Theoretical atmospheric models are formulated that consider Saturn's gravitational attraction and magnetospheric properties in forming this toroid and in protecting toroid particles from direct ionization by solar wind particles. G.G.

N74-20491* Centre National de la Recherche Scientifique, Paris (France).
ATOMIC HYDROGEN DISTRIBUTION
N. Tabarie *In* NASA. Ames Res. Center The Atmos. of Titan 1974 p 123-133 refs (For availability see N74-20478 11-30)
CSCL 03B

Several possible H2 vertical distributions in Titan's atmosphere are considered with the constraint of 5 km-A a total quantity. Approximative calculations show that hydrogen distribution is quite sensitive to two other parameters of Titan's atmosphere: the temperature and the presence of other constituents. The escape fluxes of H and H2 are also estimated as well as the consequent distributions trapped in the Saturnian system.
Author

N74-20492* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ORGANIC CHEMISTRY IN THE ATMOSPHERE
C. Sagan *In its* The Atmos. of Titan 1974 p 134-142 refs (For availability see N74-20478 11-30)
CSCL 03B

The existence of an at least moderately complex organic chemistry on Titan is stipulated based on clear evidence of methane, and at least presumptive evidence of hydrogen in its atmosphere. The ratio of methane to hydrogen is the highest of any atmosphere in the solar system. Irradiation of hydrogen/methane mixtures produces aromatic and aliphatic hydrocarbons. A very reasonable hypothesis assumes that the red cloud cover of Titan is made of organic chemicals. Two-carbon hydrocarbons experimentally produced from irradiated mixtures of methane, ammonia, water, and hydrogen bear out the possible organic chemistry of the Titanian environment. G.G.

N74-20493* Cornell Univ., Ithaca, N.Y.
RADIO OBSERVATIONS OF TITAN
F. H. Briggs *In* NASA. Ames Res. Center The Atmos. of Titan 1974 p 143 (For availability see N74-20478 11-30)
CSCL 03A

Saturn and Titan have been observed at three frequencies (1420, 2695, and 8085 MHz) with the NRAO interferometer. A clear positive Titan detection has been obtained at 8085 MHz. Assuming Titan's radius is 2500 km, the radio brightness temperature (i.e. for unit emissivity) is 115 + or - 35 K.
Author

N74-20494* Naval Research Lab., Washington, D.C.
TEMPERATURE OF THE THERMOSPHERE
D. L. Strobel *In* NASA. Ames Res. Center The Atmos. of Titan 1974 p 144 (For availability see N74-20478 11-30)
CSCL 03B

The vertical temperature contrast for the thermosphere of Titan is estimated considering heating by absorption of solar energy, energy loss through infrared radiation by polyatomic molecules, and energy transfer by thermal conduction between the regions of energy deposition and loss. Current observational data suggest a CH4/H2 mixing ratio of approximately greater than 1, and a vertical temperature contrast smaller than 10 K. However, it is highly probable that H2 and CH4 are not in equilibrium in the thermosphere if there are large H2 escape rates.
Author

N74-20495* Kitt Peak National Observatory, Tucson, Ariz.
THE 8-13 MICRON OBSERVATIONS OF TITAN
F. C. Gillett, W. J. Forrest, and K. M. Merrill *In* NASA. Ames Res. Center The Atmos. of Titan 1974 p 145-148 refs Repr. from Astrophys. J., v. 184, 1973 p 93-95 (For availability see N74-20478 11-30)
(Grant NGL-05-005-003)
CSCL 03B

Narrow band observations of Titan at selected wavelengths in the 8-13 micron range show evidence for a strong temperature inversion and the existence of at least one more spectroscopically active component in the atmosphere in addition to H2 and CH4.
Author

N74-20496* Cornell Univ., Ithaca, N.Y.
STELLAR OCCULTATIONS
J. Veverka *In* NASA. Ames Res. Center The Atmos. of Titan 1974 p 149-153 refs (For availability see N74-20478 11-30)
(Grant NGR-33-010-082)
CSCL 03A

It is important that future occultations by Titan be predicted well in advance, and imperative that they be observed adequately. Stellar occultations can yield reliable temperature/number density profiles of Titan's upper atmosphere near the density level. The temperature profiles can be used to discriminate between atmospheric compositions having high mean molecular weights, and those having low mean molecular weights. Detection of spikes at several wavelengths with high time resolution gives useful limits on the helium content of the atmosphere.
Author

N74-20497* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TITAN PHOTOMETRIC PARAMETERS
R. L. Younkin *In* NASA. Ames Res. Center The Atmos. of Titan 1974 p 154-160 refs (For availability see N74-20478 11-30)
(Contract NAS7-100)
CSCL 03B

Measurements of the irradiance of Titan from 0.05 to 1.08 micrometer were carried out by 60-inch reflector, spectrometer, and pulse counting electronics. An approximate contour of the geometric albedo assumes methane is the principal absorber. The albedo of Titan reaches a maximum value of 0.37 at 0.68, 0.753, and 0.83 micrometers, while in the center of the strongest absorption features, at 0.89 and 1.0. micrometer, it falls to 0.10. Comparison with the methane bands of Jupiter and Saturn indicates that the maxima clearly do not represent the continuum and that the lower values may well be depressed by wings of methane bands adjacent to them.
Author

N74-20498*# Linguistic Systems, Inc., Cambridge, Mass.
THERMODYNAMIC CHARACTERISTICS OF THE LOWER ATMOSPHERE OF VENUS ACCORDING TO THE RESULTS OF EXPERIMENTS BY THE DESCENT MODULES AMS OF VENERA-4
V. V. Mikhnevich and V. A. Sokolov Washington NASA Mar. 1974 8 p refs Transl. into ENGLISH from the publ. "Fizika Luny i Planet" Moscow, Nauka, 1972 p 251-254
(Contract NASw-2482)
(NASA-TT-F-15429) Avail: NTIS HC $4.00 CSCL 03B

Results are summarized of experiments made aboard the descent module of Venera-4 concerning the thermodynamic characteristics of the lower atmosphere of Venus. Results presented include measurements of temperature, density, and pressure according to altitude above the planet.
Author

N74-20499*# Scientific Translation Service, Santa Barbara, Calif.
CERTAIN CHARACTERISTICS OF THE FIELDS OF THE OUTGOING THERMAL RADIATION OF THE VENUS AND MARS ATMOSPHERE
A. M. Bunakova and K. Ya. Kondratyev Washington NASA Mar. 1974 17 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Fiz. Atmos. Okeana (Moscow), V. 9, no. 3, 1973 p 248-254
(Contract NASw-2483)
(NASA-TT-F-14764) Avail: NTIS HC $4.00 CSCL 03B

A study of spectral and angular variations of the outgoing thermal radiation for the atmosphere of Mars and the upper (above-cloud) atmosphere of Venus was performed using the numerical method for the solution of the transfer equation. Calculations of the intensity of thermal radiation iota sub lambda (theta, H) are made for the spherical pure CO2 atmosphere. The values for iota sub lambda (theta, H) are calculated in a spectral range of lambda = 3 (0.1) 50 microns for zenith angles theta = 0 (0.5) 85 percent at a height of the observational point H = 100 km. Comparison is made of outgoing radiation integral fluxes of Venus as calculated for various models of its atmosphere. It is shown that the character of the spectral and angular variation of radiation essentially depends on the choice of the upper atmospheric stratification.
Author

N74-20500*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DEEP SPACE NETWORK SUPPORT OF THE MANNED

SPACE FLIGHT NETWORK FOR APOLLO, VOLUME 3
R. B. Hartley 1 Mar. 1974 76 p refs
(Contract NAS7-100)
(NASA-CR-137347; JPL-TM-33-452-Vol-3) Avail: NTIS HC $7.00 CSCL 22C

The Deep Space Network (DSN) activities in support of Project Apollo during the period of 1971 and 1972 are reported. Beginning with the Apollo 14 mission and concluding with the Apollo 17 mission, the narrative includes, (1) a mission description, (2) the NASA support requirements placed on the DSN, and, (3) a comprehensive account of the support activities provided by each committed DSN deep space communication station. Associated equipment and activities of the three elements of the DSN (the Deep Space Instrumentation Facility (DSIF), the Space Flight Operations Facility (SFOF), and the Ground Communications Facility (GCF)) used in meeting the radio-metric and telemetry demands of the missions are documented. Author

N74-20501*# Kanner (Leo) Associates, Redwood City, Calif.
OPTICAL PROPERTIES OF THE LOWER ATMOSPHERE OF VENUS (INTERPRETATION OF MEASUREMENTS OF THE VENERA 8 SPACECRAFT)
L. G. Titarchuk Washington NASA Nov. 1973 11 p refs Transl. into ENGLISH from Kosm. Issled. (Moscow), v. 9, no. 4, 1973 p 602-606
(Contract NASw-2481)
(NASA-TT-F-14770) Avail: NTIS HC $4.00 CSCL 03B

Interpretations of the measured radiation scattered by the atmosphere in the band from 5000 A - 8000 A suggest an atmospheric model of a pure gas medium consisting of 100% CO2. Calculations based on the measurements support the model and it is concluded that the atmosphere of Venus consists of two layers differing sharply in their optical and physical characteristics. The lower layer, located below 28 km, consists of pure gas; conservative Raleigh scattering is present. In the upper, cloud layer, extending from 28 km to 65 km, conservative adsorption and scattering of visible light occurs. The cloud layer is significantly more transparent for radiation in the 6300 A - 8000 A band. K.M.M.

N74-20502*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE INNER ZONE ELECTRON MODEL AE-5
Michael J. Teague and James I. Vette Nov. 1972 200 p refs
(NASA-TM-X-69987; NSSDC-72-10) Avail: NTIS HC $13.00 CSCL 03B

A description is given of the work performed in the development of the inner radiation zone electron model, AE-5. A complete description of the omnidirectional flux model is given for energy thresholds E sub T in the range 4.0 > E sub T/(MeV) > 0.04 and for L values in the range 2.8 > L > 1.2 for an epoch of October 1967. Confidence codes for certain regions of B-L space and certain energies are given based on data coverage and the assumptions made in the analysis. The electron model programs that can be supplied to a user are referred to. One of these, a program for accessing the model flux at arbitrary points in B-L space and arbitrary energies, includes the latest outer zone electron model and proton model. The model AE-5, is based on data from five satellites, OGO 1, OGO 3, 1963-38C, OV3-3, and Explorer 26, spanning the period December 1964 to December 1967. Author

N74-20503*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A MODEL ENVIRONMENT FOR OUTER ZONE ELECTRONS
G. Wayne Singley and James I. Vette Dec. 1972 127 p refs
(NASA-TM-X-69989; NSSDC-72-13) Avail: NTIS HC $9.50 CSCL 03B

A brief morphology of outer zone electrons is given to illustrate the nature of the phenomena that we are attempting to model. This is followed by a discussion of the data processing that was done with the various data received from the experimenters before incorporating it into the data base from which this model was ultimately derived. The details of the derivation are given, and several comparisons of the final model with the various experimental measurements are presented. Author

N74-20504*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LUNAR AND PLANETARY MAPS AND CHARTS AVAILABLE FOR PUBLIC SALE
May 1973 9 p refs
(NASA-TM-X-69983; NSSDC-73-06) Avail: NTIS HC $4.00 CSCL 08B

A catalog of lunar and planetary charts which are available from the U.S. Government Printing Office is presented. The charts are identified by the area of the lunar topology involved and the prices of each chart are shown. P.N.F.

N74-20505*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
INTERDISCIPLINARY STUDIES OF SAMPLES FROM BOULDER 1, STATION 2, APOLLO 17, VOLUME 1
R. W. Wolfe, (ed.) 15 Mar. 1974 194 p refs
(Grant NGL-09-015-150)
(NASA-CR-134215; SAO-403-003) Avail: NTIS HC $12.75 CSCL 03B

Geomorphological studies on rock samples from the Apollo 17 lunar landing site are presented. For individual titles, see N74-20506 through N74-20518.

N74-20506* National Aeronautics and Space Administration, Washington, D.C.
THE GEOLOGIC SETTING OF BOULDER 1, STATION 2
H. H. Schmitt, R. W. Wolfe (Smithsonian Astrophys. Obs.), and W. M. Muehlberger (Texas Univ.) *In* Smithsonian Astrophys. Obs. Interdisciplinary Studies of Samples From Boulder 1, Sta. 2, Apollo 17, Vol. 1 15 Mar. 1974 p 1-8 refs (For availability see N74-20505 11-30)
CSCL 03B

Apollo 17 landed on the flat floor of a deep, narrow valley embayed in the mountainous highlands that comprise the southeastern rim of Mare Serenitatis. Serenitatis is one of the youngest multiringed basins on the lunar nearside and is underlain by a mascon. The valley of Taurus-Littrow, which is radial to the basin, is generally interpreted as a graben formed as a result of structural adjustments of the lunar crust in response to the Serenitatis event. Author

N74-20507* Smithsonian Astrophysical Observatory, Cambridge, Mass.
MORPHOLOGY AND SURFACE MAPPING
Ursula B. Marvin *In its* Interdisciplinary Studies of Samples From Boulder 1, Sta. 2, Apollo 17, Vol. 1 15 Mar. 1974 p 9-33 (For availability see N74-20505 11-30)
CSCL 03B

Of the many boulders photographed at the Apollo 17 site, boulder 1 from Station 2 is unique in having a strongly developed foliation. Resistant layers form four steeply inclined ridges separated by joint planes or by deeply eroded beds of softer materials. A prominent cleavage, or set of cross joints, is oriented almost normal to the foliation. The cleavage is expressed as subparallel cracks, some of which are open fissures. The entire surface of the boulder is rough and studded by dark colored knobs ranging in diameter from 1 to 15 cm. It is a polymict breccia containing at least one type of rock that has not been recognized in any other lunar sample, and it records an unusual minor element distribution and magnetic history. Author

N74-20508* Smithsonian Astrophysical Observatory, Cambridge, Mass.
PETROLOGY
D. B. Stoeser, R. W. Wolfe, J. A. Wood, and J. F. Bower *In its* Interdisciplinary Studies of Samples From Boulder 1, Sta. 2, Apollo 17, Vol. 1 15 Mar. 1974 p 35-109 refs (For availability see N74-20505 11-30)
CSCL 03B

Boulder 1 as a whole can be considered a complex polymict breccia consisting of lithic and breccia clasts seated in a matrix that ranges from friable and poorly sintered to densely welded. Only two of the four samples collected from boulder 1, Station 2 have been examined in detail: 72255 and 72275. Of the remaining two, only two undocumented thin sections from 72235 have been studied, while none from 72215 has been examined. Sample 72275 was collected as representative of

the boulder matrix, whereas the other three samples were thought to be large clasts. Author

N74-20509* Smithsonian Astrophysical Observatory, Cambridge, Mass.
PRELIMINARY RESULTS OF EXPERIMENTS TO DUPLICATE BOULDER TEXTURES BY THERMAL SINTERING OF POWDERS
Marie E. Hallam *In its* Interdisciplinary Studies of Samples From Boulder 1, Sta. 2, Apollo 17, Vol. 1 15 Mar. 1974 p 111-120 refs (For availability see N74-20505 11-30)
CSCL 03B

Experiments seem to indicate that at the low pressures characteristic of an ejecta blanket, sintering or sintering/devitrification could have lithified boulder 1 matrix materials and produced the textural types observed in 72255 and 72275. This very preliminary conclusion is consistent with other observations that granitic clasts have undergone a slight degree of partial melting (and have therefore experienced temperatures on the order of 1000 C). It is concluded that maskelynite in the boulder is completely devitrified. Author

N74-20510* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
MAJOR AND TRACE ELEMENT CONCENTRATIONS IN SAMPLES FROM 72275 AND 72255
L. A. Haskin, D. P. Blanchard, R. Korotev, J. W. Jacobs, J. A. Brannon, and A. G. Herrmann (Lunar Sci. Inst.) *In* Smithsonian Astrophys. Obs. Interdisciplinary Studies of Samples from Boulder 1, Sta. 2, Apollo 17, Vol. 1 15 Mar. 1974 p 121-129 refs (For availability see N74-20505 11-30)
CSCL 03B

Analytical data have been obtained for Co, Sc, Hf, Zn, Cr, Ga, Rb, Cs, Ni, major elements, and rare earth elements in eight samples from boulder 1. The data for trace elements were obtained by radiochemical neutron activation analysis. Major elements, except Na and Mn, were obtained by atomic absorption spectral photometry. Values for Na and Mn were obtained by neutron activation analysis of the same powder that was later dissolved to provide the atomic absorption analyses. Author

N74-20511* Chicago Univ., Ill. Dept. of Chemistry.
SIDEROPHILE AND VOLATILE TRACE ELEMENTS IN 72255 AND 72275
John W. Morgan, R. Ganapathy, Hideo Higuchi, and Edward Anders *In* Smithsonian Astrophys. Obs. Interdisciplinary Studies of Samples from Boulder 1, Sta. 2, Apollo 17, Vol. 1 15 Mar. 1974 p 131-137 refs (For availability see N74-20505 11-30)
CSCL 03B

Of six samples from boulder 1 at Station 2, four contain a unique meteoritic component, which is attributed to the Crisium projectile. The other two samples are meteorite free, igneous rocks: an unusual, alkali- and Ge-rich pigeonitic basalt, and an alkali-poor norite of unexceptional trace element chemistry. Author

N74-20512* Australian National Univ., Canberra. Dept. of Geophysics and Geochemistry.
Rb-Sr AGE OF THE CIVET CAT CLAST, 72255, 41
W. Compston and C. M. Gray *In* Smithsonian Astrophys. Obs. Interdisciplinary Studies of Samples from Boulder 1, Sta. 2, Apollo 17, Vol. 1 15 Mar. 1974 p 139-143 ref (For availability see N74-20505 11-30)
CSCL 03B

Plagioclase rich clasts, orthopyroxene rich matrix, purified pyroxene, and plagioclase from the Civet Cat clast define a Rb-Sr isochron age of 4.18 + or - 0.04 x 10 to the 9th power yr and an initial Sr-87/Sr-86 ratio of 0.69922 + or - 0.00005. The fit of all data to the line is within error except for plagioclase 3, and blank corrections are essentially negligible. The decay constant used is 1.39 x 10 to the minus 11th power yr. Author

N74-20513* Geological Survey, Denver, Colo.
U-Th-Pb SYSTEMATICS
P. D. Nunes and M. Tatsumoto *In* Smithsonian Astrophys. Obs. Interdisciplinary Studies of Samples from Boulder 1, Sta. 2, Apollo 17, Vol. 1 15 Mar. 1974 p 145-148 ref (For availability see N74-20505 11-30)
CSCL 03B

The following boulder samples are analyzed for U, Th, and Pb concentrations and for Pb isotopic compositions: 72275,53/matrix; 72275,73/matrix; 72275,81/dark rind, clast #1; 72275,117/white interior, clast #1; 72255,49/Civet Cat clast; 72255,54/light gray matrix; and 72255,67/dark gray matrix. Author

N74-20514* California Univ., Berkeley. Dept. of Physics.
TRACK STUDIES OF SAMPLES 72255 AND 72275
I. D. Hutcheon *In* Smithsonian Astrophys. Obs. Interdisciplinary Studies of Samples from Boulder 1, Sta. 2, Apollo 17, Vol. 1 15 Mar. 1974 p 149-151 (For availability see N74-20505 11-30)
CSCL 03B

Optical microscopic studies of two intermediate pieces of 72255, located 1 to 3 cm below the surface, indicate an upper limit to the track exposure age of 15 to 20 m.y. A striking feature of the track studies of breccias 72255 and 72275 is the peculiar etching behavior of many of the feldspar and olivine crystals. After standard etching procedures, crystal surfaces are frequently irregular and bumpy, presumably owing to nonuniform dissolution of the surface. Although this effect was not observed in feldspars or olivines in samples from other missions, it is apparently widespread among Apollo 17 samples. Author

N74-20515* Minnesota Univ., Minneapolis. Dept. of Geology and Geophysics.
A PRELIMINARY REPORT ON THE MAGNETIC MEASUREMENTS OF SAMPLES 72275 AND 72255
S. K. Banerjee *In* Smithsonian Astrophys. Obs. Interdisciplinary Studies of Samples from Boulder 1, Sta. 2, Apollo 17, Vol. 1 15 Mar. 1974 p 153-156 (For availability see N74-20505 11-30)
CSCL 03B

The direction and magnitude of natural remanent magnetization of five approximately 3-g subsamples of 72275 and 72255 and the high field saturation magnetization, coercive force, and isothermal remanent magnetization of 100-mg chip from each of these samples, were studied. Given an understanding of the magnetization processes, group 1 experiments provide information about the absolute direction of the ancient magnetizing field and a qualitative estimate of its size (paleointensity). The group 2 experiments yield a quantitative estimate of the iron content and a qualitative ideal of the grain sizes. Author

N74-20516* Massachusetts Inst. of Tech., Cambridge. Planetary Astronomy Lab.
SPECTRAL REFLECTANCE OF 72275 FROM BOULDER 1, STATION 2, APOLLO 17
John B. Adams and Thomas B. McCord *In* Smithsonian Astrophys. Obs. Interdisciplinary Studies of Samples from Boulder 1, Sta. 2, Apollo 17, Vol. 1 15 Mar. 1974 p 157-160 refs (For availability see N74-20505 11-30)
CSCL 03B

Spectral reflectance measurements were made of samples 72275,103 (chip) and 72275,98 (saw cuttings). Both the chips and the cuttings consist mainly of friable feldspathic breccia. Sample 72275,103, a chip taken from eastend piece 72275,27, is rich in gray polymict breccia. The saw cuttings were derived from the entire rock, but they are probably strongly biased toward the friable feldspathic matrix material that has been preferentially disaggregated. The spectra of both samples show two prominent absorption bands arising from Fe2(+) in pyroxene. The depths of these bands are large enough to preclude the presence of much glass or opaque material in the samples. From the spectral properties alone, it is clear that the samples are not soil breccias nor vitric breccias, as, of course, has been verified by petrography. The wavelengths of the principal absorption bands plot on the pyroxene trend, indicating that orthopyroxene is spectrally dominant. Author

N74-20517* Smithsonian Astrophysical Observatory, Cambridge, Mass.
APPENDIX A: SPECIMEN 72275 DOCUMENTATION
Ursula B. Marvin *In its* Interdisciplinary Studies of Samples from Boulder 1, Sta. 2, Apollo 17, Vol. 1 15 Mar. 1974

p 161-178 (For availability see N74-20505 11-30)
CSCL 03B

The friability of the matrix of specimen 72275 caused numerous fragments and an abundance of fines to break away from the main mass during transport from the moon and handling in the lunar receiving laboratory. Samples 72275,1 to 72275,14 were labeled during PET examination. Samples 72275,1, 4, 6, 7, 8, and 9 were placed in storage, and the remainder were distributed. Author

N74-20518* Smithsonian Astrophysical Observatory, Cambridge, Mass.
APPENDIX B: SPECIMEN 72255 DOCUMENTATION
Ursula B. Marvin *In its* Interdisciplinary Studies of Samples from Boulder 1, Sta. 2, Apollo 17, Vol. 1 15 Mar. 1974 p 179-191 (For availability see N74-20505 11-30)
CSCL 03B

Three documented pieces broke away from specimen 72255 during transport. Samples 72255,1 to 72255,9 were assigned numbers during examination, samples 72255,3 to 72255,6 and 72255,9 were placed in storage, and the remainder were distributed. Author

N74-20519*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMETARY COMA IONS
A. C. Aikin Apr. 1974 10 p refs Submitted for publication (NASA-TM-X-70618; X-625-74-85) Avail: NTIS HC $4.00 CSCL 03B

For comets whose nuclei are composed of water ice conglomerates it is shown that the ion H3O(+) can predominate to distances of 5000 km in the subsolar direction. Beyond this distance H2O(+) is the most important ion. The crossover point is a sensitive function of the rate of evaporation from the nucleus. The presence of ammonia or metals such as sodium, in concentrations greater than 0.1% H2O, can lead to NH4(+) and Na(+) ions. Author

N74-20520*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LOW THRUST SPACE VEHICLE TRAJECTORY OPTIMIZATION USING REGULARIZED VARIABLES
K. J. Schwenzfeger Washington Apr. 1974 40 p refs
(NASA-TR-R-426; M122) Avail: NTIS HC $3.25 CSCL 22A

Optimizing the trajectory of a low thrust space vehicle usually means solving a nonlinear two point boundary value problem. In general, accuracy requirements necessitate extensive computation times. In celestial mechanics, regularizing transformations of the equations of motion are used to eliminate computational and analytical problems that occur during close approaches to gravitational force centers. It was shown in previous investigations that regularization in the formulation of the trajectory optimization problem may reduce the computation time. In this study, a set of regularized equations describing the optimal trajectory of a continuously thrusting space vehicle is derived. The computational characteristics of the set are investigated and compared to the classical Newtonian unregularized set of equations. The comparison is made for low thrust, minimum time, escape trajectories and numerical calculations of Keplerian orbits. The comparison indicates that in the cases investigated for bad initial guesses of the known boundary values a remarkable reduction in the computation time was achieved. Furthermore, the investigated set of regularized equations shows high numerical stability even for long duration flights and is less sensitive to errors in the guesses of the unknown boundary values. Author

N74-20521# Joint Publications Research Service, Arlington, Va.
OPTICAL OBSERVATIONS OF DISTANT ARTIFICIAL SPACE OBJECTS
Ye. S. Agapov, V. F. Anisismov, P. P. Dobronravin, V. M. Mozhzherin, V. K. Prokofyev, and N. S. Chernykh 11 Apr. 1974 16 p ref Transl. into ENGLISH from Priroda (Moscow), no. 2, 1974 p 10-17
(JPRS-61728) Avail: NTIS HC $4.00

A description is given of methods and equipment employed in the optical observations of distant artificial space objects. Author

N74-20522# Joint Publications Research Service, Arlington, Va.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 320
14 Mar. 1974 68 p refs Transl. into ENGLISH from various Soviet bloc publications
(JPRS-61477) Avail: NTIS HC $6.50

Translations and abstracts are presented of articles on meteorology, oceanography, upper atmosphere and space research, astronomy, and terrestrial geophysics, covering both science news and formal scientific reports. Author

N74-20523*# Kanner (Leo) Associates, Redwood City, Calif.
VENUS
L. V. Samsonenko Washington NASA Mar. 1974 79 p refs Transl. into ENGLISH from the publ. "Astronomiya 1969: Planety Zemnoy Gruppy" Moscow, VINITI Press, 1970 p 19-89
(Contract NASw-2481)
(NASA-TT-F-15415) Avail: NTIS HC $7.00 CSCL 03B

Recent investigations of the planet Venus are reviewed on the basis of a wide survey of domestic and foreign literature. The individual topics examined include the configuration and seasons of the planet; its mass, radius, rotation, internal structure, magnetic field, captured radiation belts, photometric properties and optical parameters; radio temperature and thermal and dielectric properties of the surface; composition of the Venusian atmosphere; spectral observations above the cloud layer; the composition of the lower Venusian atmosphere from Venera-4 data; and the physical conditions below the cloud layer. Author

N74-20524*# Techtran Corp., Glen Burnie, Md.
INVESTIGATION OF THE CHEMICAL COMPOSITION OF THE ATMOSPHERE OF VENUS BY THE VENERA-4 AUTOMATIC STATION
A. P. Vinogradov, Yu. A. Surkov, and K. P. Florenskiy Washington NASA Apr. 1974 15 p refs Transl. into ENGLISH from the book "Fizika Luny i Planet" Moscow, Nauka Press, 1972 p 244-250
(Contract NASw-2485)
(NASA-TT-F-15432) Avail: NTIS HC $4.00 CSCL 03B

The data transmitted to earth by the Venera-4 automatic station during its descent by parachute in the Venusian atmosphere indicate that Venus has less hydrogen than earth. It is concluded that the greenhouse effect has produced a dense corrosive atmosphere which has leveled the surface of the planet. Author

N74-20525*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
A THERMODYNAMIC CHART FOR THE MARS ATMOSPHERE
David E. Pitts Mar. 1974 20 p refs
(NASA-TM-X-58114; JSC-08683) Avail: NTIS HC $4.00 CSCL 03B

A thermodynamic chart in which area represents energy per unit of mass is constructed for the Mars atmosphere. A surface pressure of 8 millibars and an atmospheric composition of approximately 100 percent carbon dioxide are assumed. Mixing-ratio and equivalent potential temperature lines are drawn to facilitate the study of water-vapor condensation. The region of sublimation of carbon dioxide is presented for the study of the formation of carbon dioxide clouds and surface frost. Author

N74-20526*# Scripta Technica, Inc., Washington, D.C.
THE METEOROLOGY OF MARS
K. Ya. Kondratyev and A. M. Bunakova NASA Apr. 1974 72 p refs Transl. into ENGLISH of the book "Meteorologiya Marsa" Leningrad, Hydrometeorological Press, 1973 63 p
(Contract NASw-2484)
(NASA-TT-F-816) Avail: NTIS HC $3.75 CSCL 03B

The principal features of the Martian weather are described for analysis of the problem of this planet's meteorology, for comparison of planets of the terrestrial group in regard to the specifics of their weather. Unsolved problems of Martian meteorology and the prospects for further research are briefly discussed. Author

N74-20527# Los Alamos Scientific Lab., N.Mex.
TEMPORAL OBSERVATIONS OF THE LAMBDA 5303

EMISSION LINE PROFILE DURING THE 74 MINUTE TOTALITY FROM THE CONCORDE SST AT THE 30 JUNE 1973 TOTAL SOLAR ECLIPSE: PRELIMINARY INTENSITY VARIATIONS ABOVE AN ACTIVE REGION
D. H. Liebenberg and M. M. Hoffman 28 Aug. 1973 9 p refs Presented at Intern. Astron. Union Symp. on Coronal Disturbances, Surfers Paradise, Australia, 3 Sep. 1973 Sponsored by AEC
(LA-UR-73-1304; Conf-730953-1) Avail: NTIS HC $3.00

Apparatus was designed for installation on the Concorde SST to provide high resolution emission line profiles at the June 30, 1973 total solar eclipse. A prime objective was to obtain profiles that could be used to detect the coronal response to the 5 min periodicities observed in the solar photosphere. Stability of the sky scattered light, drastic reduction of seeing effects enhanced the value of the exceptional opportunity. Preliminary results are discussed for a single region on the limb, above an active sunspot group. Author (NSA)

N74-20528# Chalmers Univ. of Technology, Goteborg (Sweden). Research Lab. of Electronics.
TEMPORAL VARIATIONS OF OH GROUND STATE EMISSIONS IN W51
J. Elider, O. E. H. Rydbeck, and A. Sume 1973 52 p refs (PB-226180/8GA; RR-117) Avail: NTIS HC $4.75 CSCL 03B

The ground state Lambda - doublet radiation of OH at the frequencies 1612, 1665, 1667, and 1720 MHz has been observed in the direction of W51 during the time period Dec. 1967 to Jun. 1973. Clear cut variations have been seen in the 1612 (RC), 1665 (RC and LC), and 1720 MHz (RC and LC) spectra, the time scale of the variations being of the order of months. Two strong peaks in the 1665 MHz spectra have risen monotonically since 1970. The main peak in the 1665 MHz (LC) spectrum has risen to one of the strongest of all known OH features. Strongly varying features in the 1612 (RC) and 1720 MHz (RC) spectra are found at about the same radial velocity as the growing 1665 MHz features. Author (GRA)

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also; 28 Propulsion Systems; and 32 Structural Mechanics.

N74-20529*+ Chrysler Corp., New Orleans, La. Space Div.
RESULTS OF TESTS OA12 AND IA9 IN THE AMES RESEARCH CENTER UNITARY PLAN WIND TUNNELS ON AN 0.030-SCALE MODEL OF THE SPACE SHUTTLE VEHICLE 2A TO DETERMINE AERODYNAMIC LOADS, VOLUME 14
R. H. Spangler (Rockwell Intern.) Downey, Calif.) Feb. 1974 1112 p refs 18 Vol.
(Contract NAS9-13247)
(NASA-CR-128794-Vol-14; DMS-DR-2032-Vol-14) Avail: NTIS HC $58.75 CSCL 22B

Tests were conducted in wind tunnels during April and May 1973, on a 0.030-scale replica of the Space Shuttle Vehicle Configuration 2A. Aerodynamic loads data were obtained at Mach numbers from 0.6 to 3.5. The investigation included tests on the integrated (launch) configuration and the isolated orbiter (entry configuration). The integrated vehicle was tested at angles of attack and sideslip from -8 degrees to +8 degrees. The isolated orbiter was tested at angles of attack from -15 degrees to +40 degrees and angles of sideslip from -10 degrees to +10 degrees as dictated by trajectory considerations. The effects of orbiter/external tank incidence angle and deflected control surfaces on aerodynamic loads were also investigated. Tabulated pressure data were obtained for upper and lower wing surfaces and left and right vertical tail surfaces. Author

N74-20530*+ Chrysler Corp., New Orleans, La. Space Div.
RESULTS OF TESTS OA12 AND IA9 IN THE AMES RESEARCH CENTER UNITARY PLAN WIND TUNNELS OF A 0.030-SCALE MODEL OF THE SPACE SHUTTLE VEHICLE 2A TO DETERMINE AERODYNAMIC LOADS, VOLUME 15
R. H. Spangler (Rockwell Intern., Downey, Calif.) Feb. 1974 912 p 18 Vol.
(Contract NAS9-13247)
(NASA-CR-128794-Vol-15; DMS-DR-2032-Vol-15) Avail: NTIS HC $48.75 CSCL 22B

Tabulated pressure data were obtained for the following components: APU inlet, SRM booster base, and external tank and tank base. For complete abstract, see N74-20529.

N74-20531 Southern Methodist Univ., Dallas, Tex.
A STUDY OF METHODS OF ANALYSIS OF THE DYNAMICS OF FLEXIBLE SPACECRAFT Ph.D. Thesis
Richard Charles Macon, III 1973 82 p
Avail: Univ. Microfilms Order No. 74-5172

The Hybrid Coordinate Method and Perturbation Method of deriving equations of motion of a flexible spacecraft are described. Both methods are applied to an idealized craft. The methods are compared and the Hybrid Coordinate Method is found to be the better technique. This judgment is based on the greater generality of the Hybrid Coordinate Method. A method is proposed to extend the linear transformation technique of the Hybrid Coordinate Method, with its subsequent reduction in number of coordinates, to a special case of nonconstant angular velocity. The transformation is found essentially by inspection of the attitude equations. There is no need to solve an eigenvector problem. The proposed method is used to analyze the effects of flexibility on two craft which have an arbitrary angular rate parallel to one principal axis. Dissert. Abstr.

N74-20532 Michigan Univ., Ann Arbor.
ATTITUDE DETERMINATION AND CONTROL OF A SPINNING SATELLITE USING THE EARTH'S MAGNETIC FIELD Ph.D. Thesis
Thomas Terrell McElroy 1973 225 p
Avail: Univ. Microfilms Order No. 74-3690

The attitude estimation and control of an axially symmetric spinning spacecraft in an earth orbit were investigated. State estimation is performed by digitally processing three orthogonal magnetic field measurements. Attitude control is derived by passing current through a coil which is aligned to produce a magnetic moment along the spin axis of the vehicle. State estimation is performed for attitude determination utilizing the following digital filters: extended Kalman filter, iterative extended Kalman filter, iterative linear filter-smoother, second order Gaussian filter and truncated second order filter. Simulation studies indicate that all of the filters perform the state estimation task with approximately the same accuracy. The iterative linear filter-smoother and Gaussian second order filter are rejected due to poor computational characteristics. Dissert. Abstr.

N74-20533*# Computer Sciences Corp., Falls Church, Va. Aerospace Systems Operation.
FEASIBILITY STUDY OF USING SATELLITES FOR A DISASTER WARNING SYSTEM Progress Report, 29 Sep. - 26 Oct. 1973
26 Nov. 1973 88 p refs
(Contract NAS3-17795)
(NASA-CR-138020; R-3015-1-2; PR-2) Avail: NTIS HC $7.50 CSCL 22B

The development of requirements for the Disaster Warning System (DWS) was investigated in relation to the National Weather Service. Conceptual communication traffic flow patterns for the future of the NWS are studied to determine the impact of the DWS on the MWS. The planned warning systems, and satellite communications are discussed along with data collection, and communication services. F.O.S.

N74-20534*# Martin Marietta Corp., Denver, Colo.
UNIVERSAL STOWAGE MODULE FOR FUTURE SPACE EXPLORATION Final Report
Victor A. Descamp, Michael W. Hussey, Paul Garber, William Mandras, and Don McKinney 4 Jan. 1974 47 p
(Contract NAS8-29777)
(NASA-CR-138006; MCR-74-1) Avail: NTIS HC $5.50 CSCL 22B

The design effort to develop, design, and fabricate a prototype

Universal Stowage Module with universal restraints that are readily adaptable for most sizes and shapes of items that would be launched into space and returned aboard shuttle payloads is presented. Author

N74-20535*# Martin Marietta Corp., Denver, Colo.
UNIVERSAL STOWAGE MODULE FOR FUTURE SPACE EXPLORATION, DESIGN DRAWINGS
Michael W. Hussey and Paul Garber 4 Jan. 1974 47 p
(Contract NAS8-29777)
(NASA-CR-120173; MCR-74-2) Avail: NTIS HC $5.50 CSCL 22B

Design drawings are presented. For complete abstract, see N74-20534.

N74-20536*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
WIDE AREA COVERAGE RADAR IMAGING SATELLITE FOR EARTH APPLICATIONS
Grady H. Stevens and James R. Ramler Feb. 1974 111 p refs
(NASA-TM-X-71515; E-7903) Avail: NTIS HC $8.75 CSCL 22B

A preliminary study was made of a radar imaging satellite for earth applications. A side-looking synthetic-aperture radar was considered and the feasibility of obtaining a wide area coverage to reduce the time required to image a given area was investigated. Two basic approaches were examined; low altitude sun-synchronous orbits using a multibeam/multifrequency radar system and equatorial orbits up to near-synchronous altitude using a single beam system. Surveillance and mapping of ice on the Great Lakes was used as a typical application to focus the study effort. Author

N74-20537*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SPACELAB SOFT MOCKUP COMPARATIVE EVALUATION
Harry Watters 14 Feb. 1974 24 p
(NASA-TM-X-64828) Avail: NTIS HC $4.25 CSCL 22B

An assessment of two proposed Spacelab configurations with diameters of 14 and 12 feet was conducted by using two inexpensive wooden mockups containing cardboard fixtures. Also examined was an alternate mounting arrangement for the 12-foot diameter configuration, taking advantage of conforming equipment racks to the cylinder walls. A volume comparison of the three configurations was made using a life sciences payload which is considered to be one of the more voluminous payloads. It was found that crew volume in the 12-foot baseline configuration appeared marginal for the life sciences payload, especially where crewmen were engaged in activities with competing demands. The 12-foot configurations of life sciences payloads offered little margin for stowage or equipment growth. Increased demands would necessitate longer module lengths. Similar results could be expected with other large volume payloads. Author

N74-20538*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRACKING AND DATA SYSTEM SUPPORT FOR THE PIONEER PROJECT. PIONEERS 6-9, EXTENDED MISSIONS: 1 JULY 1972 - 1 JULY 1973, VOLUME 12
R. B. Miller 1 Mar. 1974 187 p refs
(Contract NAS7-100)
(NASA-CR-137982; JPL-TM-33-426-Vol-12) Avail: NTIS HC $12.50 CSCL 22D

The Tracking and Data System supported the deep space phases of the Pioneer 6, 7, 8, and 9 missions, with two spacecraft in an inward trajectory and two spacecraft in an outward trajectory from the earth in heliocentric orbits. During the period of this report, scientific instruments aboard each of the spacecraft continued to register information relative to interplanetary particles and fields, and radiometric data generated by the network continued to contribute to knowledge of the celestial mechanics of the solar system. In addition, to network support activity detail, network performance and special support activities are covered. Author

N74-20539*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPACEFLIGHT PERFORMANCE OF SILVER COATED FEP TEFLON AS A THERMAL CONTROL SURFACE ON THE IMP-1 SPACECRAFT
Richard H. Hoffman Apr. 1973 8 p
(NASA-TM-X-66242; X-762-73-113) Avail: NTIS HC $4.00

A second surface mirror type coating, vapor deposited silver on FEP Teflon, was used as a thermal control surface for one of the experiments aboard the Imp-I spacecraft. This coating was selected to obtain the low operating temperature required for this experiment. Initial flight temperature of this thermal control surface was -70.5 C, very close to the predicted value of -73 C and at a very satisfactory level. Since temperatures within the spacecraft interior are not at this desired low level, the detectors had to be mounted exterior to the spacecraft with a good view of space, preferably in an area shaded from sunlight. When this latter preference proved unobtainable, the detectors were mounted on an aluminum plate located on the exterior of the spacecraft, parallel to the spin axis but rotating about the solar vector. The mounting plate was approximately 6.5 inches by 7.5 inches by 0.125 inches thick. To achieve the desired temperature level with the mounting plate in such a location, the thermal design had to minimize not only the effects of the relatively warm spacecraft environment but also the effects of the incident solar energy. Author

N74-20540*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPENDIUM OF METEOROLOGICAL SATELLITES AND INSTRUMENTATION
Norman W. Stoldt (Air Weather Service) and Peter J. Havanac (Air Weather Service) Jul. 1973 496 p refs
(NASA-TM-X-69986; NSSDC-73-02) Avail: NTIS HC $28.00 CSCL 22B

Pertinent information is presented for 98 launched and planned satellites of the U.S., U.K., U.S.S.R., and France, as well as their over 200 meteorological experiments or instruments. Summary information is provided for both operational and research satellites. Three major sections include: (1) an overview by country, of the various series of meteorological satellite programs; (2) brief descriptions of the satellites and their experiments; and (3) an extensive bibliography. A glossary of acronyms and two indexes for cross-referencing are also included. In addition, various tables and figures presenting satellite operating times, data coverage, location of launch sites, and descriptions of the launch vehicles used to orbit the meteorological satellites are given. Author

N74-20541*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A SPACE VEHICLE Patent Application
George L. VonPragenau, inventor (to NASA) Filed 21 Mar. 1974 18 p
(NASA-Case-MFS-22734-1; US-Patent-Appl-SN-453232) Avail: NTIS HC $4.00 CSCL 22B

A space vehicle with an improved ascent configuration was designed. The spacecraft consisted of a winged orbiter with an elongated fuselage and rearwardly directed main engines fixed to the fuselage. A tank assembly located on the forward portion of the fuselage and connected with the main engines supplies liquid rocket propellants. A booster stage consisting of a pair of integrated solid rocket boosters is connected with the orbiter immediately below the fuselage and parallel to it. Drawings of the spacecraft configuration are provided. An analysis of the anticipated performance characteristics is developed. Official Gazette of the U.S. Patent Office

N74-20542*# Texas Univ., Dallas.
OGO-6 EXPERIMENT F-03 Final Report
W. B. Hanson and S. Sanatani 15 Jul. 1973 11 p refs
(Contract NAS5-9311)
(NASA-CR-132943) Avail: NTIS HC $4.00 CSCL 22C

The results obtained with the retarding potential analyzer on the OGO-6 satellite are discussed. The information obtained during the OGO-6 flight concerned the following subjects: (1) measurement of electron flux density in the plasmasphere, (2) latitudinal variations of ion temperature, (3) heating in the nighttime ionosphere by conjugate photoelectrons, (4) longitu-

dinal variation in equatorial ion temperature at low altitude, and (5) identification of heavy ions in the upper F region. Author

N74-20543*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: MANNED THERMAL-VACUUM TESTING OF SPACECRAFT
James C. McLane, Jr. Washington Mar. 1974 69 p
(NASA-TN-D-7610; JSC-S-388) Avail: NTIS HC $3.75 CSCL 22B

Manned thermal-vacuum tests of the Apollo spacecraft presented many first-time problems in the areas of test philosophy, operational concepts, and program implementation. The rationale used to resolve these problems is explained and examined critically in view of actual experience. The series of 12 tests involving 1517 hours of chamber operating time resulted in the disclosure of numerous equipment and procedural deficiencies of significance to the flight mission. Test experience and results in view of subsequent flight experience confirmed that thermal-vacuum testing of integrated manned spacecraft provides a feasible, cost-effective, and safe technique with which to obtain maximum confidence in spacecraft flight worthiness early in the program. Author

N74-20544*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SECOND HEATED JETTISON TEST ON THE CENTAUR STANDARD SHROUD
Feb. 1974 110 p ref
(NASA-TM-X-71521; E-7902) Avail: NTIS HC $8.50 CSCL 22B

The second in a planned series of heated jettison tests on the Centaur Standard Shroud was conducted on January 16, 1974. The first 250-second portion of the test sequence involved heating the shroud with a specially-built fixture designed to provide a simulation of the heating environment encountered by the shroud during its ascent through the earth's atmosphere. The two heater halves, which were mounted on a rail system, were then retracted. This was followed by the jettison of the two shroud halves into catch nets positioned at 90 deg to the heater rails. The condition which made this test unique compared to the others in the test series was the alignment of the maximum thermal line with the shroud separation plane. Information on the test hardware, configuration, and sequence is presented. Shroud thermal and deflection data encountered during the heating portion of the test sequence are compared with free-skin design temperatures in various graphical formats. Author

N74-20545*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MSFC SORTIE LABORATORY ENVIRONMENTAL CONTROL SYSTEM (ECS) PHASE B DESIGN STUDY RESULTS
A. J. Ignatonis and K. L. Mitchell Mar. 1974 260 p refs
(NASA-TM-X-64832) Avail: NTIS HC $16.00 CSCL 22B

Phase B effort of the Sortie Lab program has concluded. Results of that effort are presented which pertain to the definitions of the environmental control system (ECS). Numerous design studies were performed in Phase B to investigate system feasibility, complexity, weight, and cost. The results and methods employed for these design studies are included. An autonomous Sortie Lab ECS was developed which utilizes a deployed space radiator. Total system weight was projected to be 1814.4 kg including the radiator and fluids. ECS power requirements were estimated at 950 watts. Author

N74-20546*# Chrysler Corp., New Orleans, La. Space Div.
RESULTS OF FLOW VISUALIZATION STUDIES IN THE NASA/MSFC 14 X 14 INCH TRISONIC WIND TUNNEL ON A .004 SCALE MODEL (34-0) SPACE SHUTTLE ORBITER AND INTEGRATED VEHICLE
W. P. Garton (Rockwell Intern., Downey, Calif.) Feb. 1974 59 p
(Contract NAS9-13247)
(NASA-CR-134087; DMS-DR-2042) Avail: NTIS HC $6.00 CSCL 22B

Details are presented of flow visualization techniques developed during wind tunnel test IA-52 conducted in a 14 x 14 inch trisonic wind tunnel. Testing was conducted from Mach = 0.9 to 5.0 on the orbiter alone and integrated vehicle configurations. Thin film oil paint and ultraviolet light sensitive oil applications were used on a .004 scale model vehicle. Test results presented are in the form of black and white photographs taken after the completion of a test run. Author

N74-20547*# Chrysler Corp., New Orleans, La. Space Div.
EFFECTS OF REACTION CONTROL SYSTEM JET SIMULATION ON THE STABILITY AND CONTROL CHARACTERISTICS OF A 0.015 SCALE SPACE SHUTTLE ORBITER MODEL TESTED IN THE LANGLEY RESEARCH CENTER UNITARY PLAN WIND TUNNEL
J. J. Daileda (Rockwell Intern., Downey, Calif.) and John Marroquin (Rockwell Intern., Downey, Calif.) Feb. 1974 120 p refs
(Contract NAS9-13247)
(NASA-CR-134070; DMS-DR-2073) Avail: NTIS HC $9.00 CSCL 22B

An experimental investigation was performed in the Langley Research Center Unitary Plan Wind Tunnel (Test 0A70) to obtain the detailed effects that RCS jet flow interactions with local orbiter flow field have on supersonic stability and control characteristics of the space shuttle orbiter. Six-component force data were obtained through an angle-of-attack range from 15 to 35 degrees at angles of sideslip of 0, +5, and -5 degrees. The test was conducted with yaw jet simulation at free-stream Mach numbers of 2.5 and 4.6, simulating SSV re-entry flight conditions at these Mach numbers. In addition to the basic force measurements, fuselage base pressures and pressures on the non-metric RCS pods were obtained. Author

N74-20548*# Chrysler Corp., New Orleans, La. Space Div.
RESULTS OF WIND TUNNEL TESTS AT MACH 5 ON THE .004 SCALE MODEL 2A CONFIGURATION SPACE SHUTTLE TO DETERMINE PROXIMITY EFFECTS AND ORBITER CONTROL EFFECTIVENESS DURING ORBITER/EXTERNAL TANK ABORT SEPARATION (IAG)
W. P. Garton (Rockwell Intern. Aerospace) Feb. 1974 232 p refs
(Contract NAS9-13247)
(NASA-CR-134071; DMS-DR-2039) Avail: NTIS HC $14.75 CSCL 22B

Results from tests in the NASA/MSFC Trisonic Wind Tunnel on 0.004-Scale Orbiter and External Tank Force Models in Close Proximity (RTLS Abort Separation Conditions) are presented. The primary test objectives were to obtain data concerning proximity effects on the aerodynamic forces and moments experienced by Vehicle 2A Configuration Shuttle Orbiter and External Tank during an abort separation (Return to Launch Site) at a Mach number of 5. Additionally, data on orbiter control effectiveness during such an abort was obtained. Proximity effects were investigated for relative angles of incidence from minus 5 deg to plus 10 deg of the orbiter FRL with respect to the external tank centerline over a range of vertical and longitudinal displacements from the mated position to 2.5 tank diameters below and 3 tank diameters aft of the mated position. Author

N74-20549*# Chrysler Corp., New Orleans, La. Space Div.
FLUTTER TESTS OF (OS1) OF THE 0.02-SCALE SHUTTLE ORBITER WING/ELEVON SEMI-SPAN MODEL 230
Michael H. Kotch (Rockwell Intern., Downey, Calif.) Feb. 1974 66 p refs
(Contract NAS9-13247)
(NASA-CR-134073; DMS-DR-2094) Avail: NTIS HC $6.50 CSCL 22B

A series of simple wing/elevon flutter models of the shuttle orbiter were tested in a 26-inch transonic blowdown tunnel. Flutter points were obtained for two levels of scaled elevon actuator stiffness. A description of the wind tunnel models and the test procedures utilized in the experiment are given. Author

N74-20550*# Linguistic Systems, Inc., Cambridge, Mass.
PROGNOZ, AUTOMATIC STATIONS
V. A. Arkhipov et al Washington NASA Mar. 1974 71 p refs Transl. into ENGLISH of "Avtomaticheskiye Stantsii 'Prognoz'", Acad. of Sci. USSR, Inst. of Space Res., Moscow, Report Pr-140, 1973 72 p
(Contract NASw-2482)
(NASA-TT-F-15287; PR-140) Avail: NTIS HC $6.75 CSCL

22B

The Prognoz space stations launched by the Soviet Union during 1972 are discussed. The stations were designed to study solar activity and its influence on the interplanetary medium and on the earth's magnetosphere. The scientific instrumentation aboard the stations is described. Tests for adjusting and calibrating the instruments on the ground and while in flight are explained.
Author

N74-20551# National Aerospace Lab., Tokyo (Japan). Space Technology Research Group.
SOME INVESTIGATIONS ON THE SEPARATION CHARACTERISTICS OF A TWO-STAGE VEHICLE MODEL
Jul. 1973 43 p refs In JAPANESE; ENGLISH summary
(NAL-TR-325) Avail: NTIS HC $5.25

Launch vehicles are often of multi-stage type in order to increase the efficiency of the vehicle system for its mission requirements. In the case of multi-stage launch vehicles, the inter-stage structures not only have to be light-weight, but also to have sufficiently high strength and stiffness. In addition, separation should not cause such undesirable motions of the vehicle as excessive shock and vibration, or bumping between the separated stages, all of which might affect the expected trajectory of the vehicles. In this study, the experiment on separation was conducted by a dynamic model which was simulated as an existing two-stage vehicle, and the results of the experiment were compared with predicted values calculated by a theoretical analysis. Also, in order to obtain the pertinent characteristics of the model for investigation of the separation dynamics, tests on the stiffness and vibration of the model were conducted, and the results were compared with the theoretical calculations.
Author

N74-20552*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DESCRIPTION AND SIMULATION OF AN INTEGRATED POWER AND ATTITUDE CONTROL SYSTEM CONCEPT FOR SPACE-VEHICLE APPLICATION
Ralph W. Will, Claude R. Keckler, and Kenneth L. Jacobs
Washington Apr. 1974 32 p refs
(NASA-TN-D-7459; L-8791) Avail: NTIS HC $3.25 CSCL 22B

An Integrated Power and Attitude Control System (IPACS) concept with potential application to a broad class of space missions is discussed. A description is given of the basic concept of combining the onboard energy storage and attitude control functions by storing energy in spinning flywheels which are used to provide control torques. A shuttle-launched Research and Applications Module (RAM) A303B solar-observatory mission having stringent pointing requirements (1.0 arc second) is selected to investigate possible interactions between energy storage and attitude control. A simulation of this spacecraft involving actual laboratory-model control-system hardware is presented. Simulation results are discussed which indicate that the IPACS concept, even in a failure-mode configuration, can readily meet the RAM A303B pointing requirements.
Author

N74-20553*# Chrysler Corp., New Orleans, La. Space Div.
RESULTS OF INVESTIGATIONS ON A 0.015-SCALE MODEL (49-0) OF THE SPACE SHUTTLE ORBITER IN THE NASA/AMES 3.5-FOOT HYPERSONIC WIND TUNNEL (OA87)
M. T. Petrozzi (Rockwell Intern., Downey, Calif.), M. D. Milam (Rockwell Intern., Downey, Calif.), and J. A. Mellenthin (NASA. Ames Res. Center) Feb. 1974 322 p
(Contract NAS9-13247)
(NASA-CR-134085; DMS-DR-2115) Avail: NTIS HC $19.25 CSCL 22B

Experimental aerodynamic investigations were conducted on a scale model of the space shuttle orbiter, Configuration 140A/B. The objectives of this test were to: 1) verify supersonic stability and control characteristics, 2) analyze aerodynamic problem areas, 3) verify control surface effectiveness, and 4) investigate Reynolds number effects. Six-component aerodynamic force and moment data were recorded over an angle of attack range from 22 deg to 46 deg at a constant sideslip angle of 0 deg. The test Mach number was varied from 5.3 to 7.3 to 10.3. The Reynolds number per unit length was varied from 805,000 to 10 million per foot.
Author

N74-20554*# Chrysler Corp., New Orleans, La.
EFFECT OF EXTERNAL TANK NOSE SHAPE ON THE ROCKWELL INTERNATIONAL SPACE SHUTTLE VEHICLE 3, INTEGRATED CONFIGURATION (IA37B)
E. C. Allen (Rockwell Intern., Huntsville) Mar. 1974 124 p
(Contract NAS9-13247)
(NASA-CR-134090; DMS-DR-2093) Avail: NTIS HC $9.25 CSCL 22B

Tests of several tank nose shapes were conducted as a part of the investigation of configuration changes to reduce drag for the integrated vehicle. The effect on the integrated vehicle aerodynamic characteristics of several tank nose shapes was investigated. The tank nose shapes investigated were the 600 inch (baseline) and 1204 inch radius ogives, and the 600 inch ogive plus a spike 360 inches long and 12.0 inches in diameter. Data were obtained over a Mach number range of 0.6 through 4.96 and for angles-of-attack and sideslip from -10 through +10 degrees. The model used was the 0.004-scale integrated vehicle model number 34-OTS.
Author

N74-20555*# Chrysler Corp., New Orleans, La. Space Div.
PHASE C AEROTHERMODYNAMIC DATA BASE
Maurice Moser, Jr. 10 Feb. 1974 82 p
(Contract NAS9-13247)
(NASA-CR-134225; DMS-DFR-2012) Avail: NTIS HC $7.25 CSCL 22B

Summary listings of published documentation of SADSAC processed data arranged chronologically and by shuttle configuration are presented to provide an up-to-date record of all applicable aerothermodynamic data collected, processed, or summarized in the course of the space shuttle program. The various tables or listings are designed to provide survey information to the various space shuttle managerial and technical levels. The various listings of the shuttle test data information, the list contents, and the purpose are described.
Author

N74-20556# Hawaii Univ., Honolulu. Dept. of Mechanical Engineering.
DYNAMICS AND CONFIGURATION CONTROL OF DUAL SATELLITE SYSTEMS
Willem Stuiver 20 Mar. 1974 24 p refs Presented at the 5th World Congr. of the Intern. Federation of Autom. Control, Paris, Jun. 1972 Backup document for AIAA Synoptic, "Dynamics and Configuration Control of Two-Body Satellite Systems", scheduled for publication in Journal of Spacecraft and Rockets on Aug. 1974
Avail: NTIS HC $4.25 CSCL 22B

An analytical method for devising computer algorithms for the automatic control of deployment and stationkeeping of dual satellite systems is presented. The equations of controlled relative motion are derived for dual satellites moving in a circular orbit of the system barycenter, assuming a control process which involves only forces internal to the system. These equations are utilized for the formulation of deployment control for satellites whose mass center motion is restricted to the system barycenter orbital plane, and whose final operational configuration consists of system baseline alignment with the local vertical. Digital simulation results obtained from application of these algorithms to some special parametric cases are presented. These results indicate the nature of system deployment trajectories involved, and corresponding control forces, as well as their sensitivity with respect to the parameters considered.
Author

N74-20557# Commissariat a l'Energie Atomique, Grenoble (France). Lab. d'Electronique et de Technologie de l'Informatique
COMPENSATION BY CORRELATION OF SPIN SIGNAL ON BOARD THE GEOS SATELLITE
H. Chevalier, J. Max, M. Dominiak, H. Lesage, W. Kofman, and P. Taveaux 23 Mar. 1973 15 p In FRENCH Presented at 4th Colloq. on the Processing of the Signal and its Appl., Nice, 7-12 May 1973
(CEA-Conf-2429; Conf-730572-2) Avail: AEC Depository Libraries HC $3.00

A procedure is introduced for processing spin signals onboard

the GEOS satellite. The method measures the amplitude and phase of the signal current and returns, in opposition of this phase, a sinusoidal signal with the same amplitude and phase.
Transl. by E.H.W.

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N74-20558 Engineering Sciences Data Unit, London (England).
THE FATIGUE STRENGTH AT HIGH ENDURANCE OF UNNOTCHED STEEL SPECIMENS (IN BENDING AND UNDER AXIAL LOADING)
Dec. 1972 15 p refs Supersedes ESDU-Fat-E.07.04 Sponsored by Roy. Aeron. Soc. and Inst. of Mech. Engr.
(ESDU-73005; ESDU-Fat-E.07.04) Copyright. Avail: Issuing Activity

Data are reported on the fatigue strength at high endurance of both low and high alloy wrought steel specimens under alternating stress. The data are grouped according to the type of the applied loading (i.e. bending or axial loading) and the type of steel; curves and test results are also given for specimens tested under zero mean stress conditions. The figures enable an assessment to be made of the maximum alternating stress that may be applied to a component which has a particular tensile strength and is required to achieve a high endurance. For low alloy steels, the effect of a mean stress on the fatigue strength at high endurance is shown by the test results. Most specimens considered were in the form of round bar, the diameter at the critical section generally being in the range 5.08 mm to 12.7 mm diameter though about 10 per cent were outside this range but were within the range 3.18 mm to 43.2 mm diameter. A few of the specimens tested in tension or bending were rectangular strips of width 38.1 mm to 102 mm and thickness 1.90 mm to 6.35 mm. Author

N74-20559 Engineering Sciences Data Unit, London (England).
THE FATIGUE STRENGTH AT HIGH ENDURANCE OF UNNOTCHED STEEL SPECIMENS (IN BENDING AND UNDER AXIAL LOADING)
Dec. 1973 14 p refs Supersedes Fat-E.07.04 Sponsored by Roy. Aeron. Soc. and Inst. of Mech. Engr.
(ESDU-73005; ESDU-FAT-E.07.04) Copyright. Avail: Issuing Activity

Data are provided on the fatigue strength at high endurance of both low and high alloy wrought steel specimens under alternating stress. The data are grouped according to the type of the applied loading (i.e. bending or axial loading) and the type of steel. Curves and test results are given for specimens tested under zero mean stress conditions. The figures enable an assessment to be made of the maximum alternating stress that may be applied to a component which has a particular tensile strength and is required to achieve a high endurance. For low alloy steels the effect of a mean stress on the fatigue strength at high endurance is shown by the test results and curves.
Author

N74-20560 Engineering Sciences Data Unit, London (England).
STIFFNESS OF LOADED FLAT STRIPS UNDER SINUSOIDALLY DISTRIBUTED BENDING COUPLES AT THEIR EDGES (FOR USE IN LOCAL BUCKLING CALCULATIONS) (UNIAXIAL OR BIAXIAL LOADING. ISOTROPIC OR ORTHOTROPIC MATERIALS)
1973 18 p refs Supersedes ESDU-Struct-02.01.29, ESDU-Struct-02.01.30, ESDU-Struct-02.01.31; ESDU-Struct-02.01.32, ESDU-Struct-02.01.33 Sponsored by Roy. Aeron. Soc.
(ESDU-73007; ESDU-Struct-02.01.29; ESDU-Struct-02.01.30; ESDU-Struct-02.01.31; ESDU-Struct-02.01.32; ESDU-Struct-02.01.33) Copyright. Avail: Issuing Activity

Curves for determining the stiffness of long flat strips initially subjected to in-plane uniform longitudinal and transverse direct stresses are presented. The stiffnesses relate to sinusoidally distributed edge rotations and the corresponding edge couples. The three modes of deformation of the flat strips are illustrated and described. In all cases the strips are taken to be infinitely long, with, excepting the one free edge in one mode, all edges simply supported. Author

N74-20561 Engineering Sciences Data Unit, London (England).
INFORMATION ON THE USE OF ITEM NO. 73007
Sep. 1973 7 p
(ESDU-02.01.28-Amend-A) Copyright. Avail: Issuing Activity

The application of data pertaining to the stiffness of loaded flat strips under sinusoidally bending couples at their edges to the estimation of the local buckling stress of stiffened panels is discussed. The data relate to thin strips of isotropic or orthotropic materials under the action of a stress acting along the strip with, or without, a direct stress acting across the strip. The data are applicable to modes of deformation which involve distortion but not translation, of the cross section. Author

N74-20562*# Kanner (Leo) Associates, Redwood City, Calif.
VARIATIONAL METHODS IN THE THEORY OF PLASTICITY
L. M. Kachanov Washington NASA Mar. 1974 32 p refs Transl. into ENGLISH from the publ. "Mekhanika Tverdogo Tela; Vsesoyuznyy S'ezd po Teoreticheskoy i Prikladnoy Mekhanike" Moscow, Nauka, 1966 p 177-190
(Contract NASw-2481)
(NASA-TT-F-15436) Avail: NTIS HC $4.75 CSCL 20K

A discussion is presented of the application of variational techniques to the solution of boundary value problems for plastic media, with particular reference to nonlinear-elastic, nonlinear-plastic, elastoplastic, and rigid-plastic bodies. The principles of the original and modified Ritz methods are outlined, showing that the modified method makes it possible to overcome the difficulties associated with the nonquadraticity of functionals and to obtain solutions in a straightforward way. The optimum-interpolation method and the variational-difference method are also explained. Author

N74-20563*# Grumman Aerospace Corp., Bethpage, N.Y.
NONLINEAR ANALYSIS OF STRUCTURES
H. Armen, H. Levine, A. Pifko, and A. Levy Washington NASA Mar. 1974 128 p refs
(Contract NAS1-10087)
(NASA-CR-2351; RE-454) Avail: NTIS HC $4.75 CSCL 20K

The development of nonlinear analysis techniques within the framework of the finite-element method is reported. Although the emphasis is concerned with those nonlinearities associated with material behavior, a general treatment of geometric nonlinearity, alone or in combination with plasticity is included, and applications presented for a class of problems categorized as axisymmetric shells of revolution. The scope of the nonlinear analysis capabilities includes: (1) a membrane stress analysis, (2) bending and membrane stress analysis, (3) analysis of thick and thin axisymmetric bodies of revolution, (4) a general three dimensional analysis, and (5) analysis of laminated composites. Applications of the methods are made to a number of sample structures. Correlation with available analytic or experimental data range from good to excellent. Author

N74-20564*# Douglas Aircraft Co., Inc., Long Beach, Calif.
ANALYSIS AND DESIGN OF ADVANCED COMPOSITE BOUNDED JOINTS Final Report
L. J. Hart-Smith Washington NASA Apr. 1974 55 p refs
(Contract NAS1-11234)
(NASA-CR-2218) Avail: NTIS HC $3.75 CSCL 20K

Advances in the analysis of adhesive-bonded joints are presented with particular emphasis on advanced composite structures. The joints analyzed are of double-lap, single-lap, scarf, stepped-lap and tapered-lap configurations. Tensile, compressive, and in-plane shear loads are covered. In addition to the usual geometric variables, the theory accounts for the strength increases attributable to adhesive plasticity (in terms of the elastic-plastic adhesive model) and the joint strength reductions imposed by

imbalances between the adherends. The solutions are largely closed-form analytical results, employing iterative solutions on a digital computer for the more complicated joint configurations. In assessing the joint efficiency, three potential failure modes are considered. These are adherend failure outside the joint, adhesive failure in shear, and adherend interlaminar tension failure (or adhesive failure in peel). Each mode is governed by a distinct mathematical analysis and each prevails throughout different ranges of geometric sizes and proportions. Author

N74-20565*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPUTER PROGRAM FOR SUPERSONIC KERNEL-FUNCTION FLUTTER ANALYSIS OF THIN LIFTING SURFACES
Herbert J. Cunningham Washington Apr. 1974 72 p refs
(NASA-TM-X-2913; L-9126) Avail: NTIS HC $3.75 CSCL 20K

This report describes a computer program (program D2180) that has been prepared to implement the analysis described in (N71-10866) for calculating the aerodynamic forces on a class of harmonically oscillating planar lifting surfaces in supersonic potential flow. The planforms treated are the delta and modified-delta (arrowhead) planforms with subsonic leading and supersonic trailing edges, and (essentially) pointed tips. The resulting aerodynamic forces are applied in a Galerkin modal flutter analysis. The required input data are the flow and planform parameters including deflection-mode data, modal frequencies, and generalized masses. Author

N74-20566*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN IMPROVED EXCEEDANCE THEORY FOR COMBINED RANDOM STRESSES
Harold C. Lester Washington Apr. 1974 41 p refs
(NASA-TR-R-418; L-9120) Avail: NTIS HC $3.25 CSCL 20K

An extension is presented of Rice's classic solution for the exceedances of a constant level by a single random process to its counterpart for an n-dimensional vector process. An interaction boundary, analogous to the constant level considered by Rice for the one-dimensional case, is assumed in the form of a hypersurface. The theory for the numbers of boundary exceedances is developed by using a joint statistical approach which fully accounts for all cross-correlation effects. An exact expression is derived for the n-dimensional exceedance density function, which is valid for an arbitrary interaction boundary. For application to biaxial states of combined random stress, the general theory is reduced to the two-dimensional case. An elliptical stress interaction boundary is assumed and the exact expression for the density function is presented. The equations are expressed in a format which facilitates calculating the exceedances by numerically evaluating a line integral. The behavior of the density function for the two-dimensional case is briefly discussed.
Author

N74-20567*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE EFFECTS OF SHOT-PEENING RESIDUAL STRESSES ON THE FRACTURE AND CRACK GROWTH PROPERTIES OF D6AC STEEL
Wolf Elber Aug. 1973 23 p refs Presented at ASTM 7th Natl. Symp. on Fracture Mech., College Park, Md., 27-29 Aug. 1973
(NASA-TM-X-71943) Avail: NTIS HC $4.25 CSCL 20K

The fracture strength and cyclic crack-growth properties of surface-flawed, shot-peened D6AC steel plate were investigated. For short crack lengths (up to 1.5mm) simple linear elastic fracture mechanics - based only on applied loading - did not predict the fracture strengths. Also, Paris' Law for cyclic crack growth did not correlate the crack-growth behavior. To investigate the effect of shot-peening, additional fracture and crack-growth tests were performed on material which was precompressed to remove the residual stresses left by the shot-peening. Both tests and analysis show that the shot-peening residual stresses influence the fracture and crack-growth properties of the material. The analytical method of compensating for residual stresses and the fracture and cyclic crack-growth test results and predictions are presented. Author

N74-20568*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INTEGRAL FLANGE DESIGN PROGRAM
John F. Wilson Mar. 1974 32 p refs
(NASA-TM-X-71933) Avail: NTIS HC $4.75 CSCL 20K

An automated interactive flange design program utilizing an electronic desk top calculator is presented. The program calculates the operating and seating stresses for circular flanges of the integral or optional type subjected to internal pressure. The required input information is documented. The program provides an automated procedure for computing stresses in selected flange geometries for comparison to the allowable code values. Author

N74-20569*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
RELIABILITY AND STRUCTURAL INTEGRITY
John R. Davidson 1973 14 p refs Presented at the 10th Anniv. Meeting of the Soc. of Eng. Sci., Raleigh, N. C., 5-7 Nov. 1973
(NASA-TM-X-71934) Avail: NTIS HC $4.00 CSCL 20K

An analytic model is developed to calculate the reliability of a structure after it is inspected for cracks. The model accounts for the growth of undiscovered cracks between inspections and their effect upon the reliability after subsequent inspections. The model is based upon a differential form of Bayes' Theorem for reliability, and upon fracture mechanics for crack growth.
Author

N74-20570# Aeronautical Research Labs., Melbourne (Australia).
STRESS DISTRIBUTIONS IN FIBRE REINFORCED PLASTIC LAMINATES UNDER SIMPLE LOADINGS
B. C. Hoskin and Beryl Green Aug. 1973 45 p refs
(ARL/SM-396) Avail: NTIS HC $5.25

Numerical examples are presented to illustrate the character of the stress distributions occurring in laminated plates of fiber reinforced plastics under simple plane loadings. Two types of laminates are considered: the first comprises equal numbers of layers oriented at +45 deg and -45 deg with respect to a laminate reference axis, and the second comprises equal numbers of layers oriented at +30 deg and 90 deg with respect to this same axis. Various types of lay-ups are considered, some of these being symmetric about the midthickness plane, while others are nonsymmetric. The applied loading is either a uniform tension or a uniform shear. The results demonstrate the marked differences in stress distributions that can occur in laminates depending on the disposition of the constituent layers about the midplane; however, they also show that in a nonsymmetric lay-up the stress distribution approaches that for a symmetric lay-up.
Author

N74-20571# National Aerospace Lab., Tokyo (Japan).
NATURAL FREQUENCIES OF CONTINUOUS PLATE
Yoichi Hayashi and Tadahiko Kawai Jul. 1973 11 p refs In JAPANESE; ENGLISH summary
(NAL-TR-328) Avail: NTIS HC $4.00

A practical method for the vibration analysis of continuous plates, which have various boundary end conditions and internal supports, is proposed. The analysis is carried out by means of the Rayleigh-Ritz procedure with an approximating deflection function W(x, y). Results of numerical examples show good agreement with experiment. Author

N74-20572# National Aerospace Lab., Tokyo (Japan).
FLEXUAL RIGIDITY OF A THIN WALLED BUILD-UP ROTOR FOR JET ENGINE. MEASUREMENT BY STATIC LOAD TEST AND VIBRATION TEST AND CALCULATION BY FINITE ELEMENT METHOD
Toshio Miyachi, Akinori Ogawa, Shoji Hoshiya, and Yasushi Sofue Jul. 1973 17 p refs In JAPANESE; ENGLISH summary
(NAL-TR-329) Avail: NTIS HC $4.00

Results of flexural rigidity tests and flexural vibration tes of a thin walled built-up rotor for a single spool jet engine are presented. Calculations of deformation of the rotor under similar loading and supporting conditions occuring in the tests are carried out by the finite element method and compared with the experimental values. Results show that: (1) The thin walled built-up rotor has very low flexural rigidity compared with the value

computed by simple beam theory. (2) The values of deformation calculated by the finite element method agree well with the experimental values by proper idealization of the built-up structure. (3) Structural damping of the built-up rotor is much larger than for rotors having a solid or welded structure. Author

N74-20573*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EFFECT OF INERTIA PROPERTIES ON ATTITUDE STABILITY OF NONRIGID SPIN-STABILIZED SPACECRAFT
W. E. Lang and J. P. Young Washington Apr. 1974 17 p refs
(NASA-TN-D-7468; G-7359) Avail: NTIS HC $3.00 CSCL 22B

The phenomenon of energy dissipation in spinning spacecraft is discussed with particular reference to its dependence on spacecraft inertia properties. Specific dissipation mechanisms are identified. The effect of external environmental factors on spin stability is also discussed. Generalized curves are presented relating system stability to the principal inertia ratio for various forms of energy dissipation. Dual-spin systems and the effect of lateral inertia asymmetry are also reviewed. Author

N74-20574# National Bureau of Standards, Washington, D.C. Center for Building Technology.
STRUCTURAL EVALUATION OF STEEL FACED SANDWICH PANELS Final Report
J. H. Pielert, T. W. Reichard, and L. W. Masters Apr. 1974 47 p refs Sponsored by HUD
(NBS-BSS-51; LC-74-5085) Avail: SOD HC $0.90 as C13.29/2:51 CSCL 20K

A series of structural evaluation tests performed on components and materials intended for use in one of the Operation BREAKTHROUGH housing systems is described. Four samples of steel faced, paper honeycomb, sandwich panel material and four full size prototype roof panels were evaluated. The samples of sandwich panel material were used to evaluate the variability of panel material properties and the effect of aging on tensile and shear strength. Roof panels were used to determine the behavior in service considering the effects of adverse environmental conditions on ultimate strength and mode of failure. In addition, the performance of one panel under sustained loading was evaluated. Author

N74-20575# Massachusetts Univ., Amherst. Dept. of Civil Engineering.
RESPONSE OF STRUCTURES TO RANDOM NOISE Final Report
William A. Nash Jul. 1973 85 p refs
(Grant AF-AFOSR-1527-68; AF Proj. 9782)
(AD-772748; AFOSR-73-2280TR) Avail: NTIS CSCL 20/11

The large amplitude vibrations of thin elastic plates and shallow shells having various boundary conditions and subjected to random excitation are investigated by using various approximate techniques. The random vibrations of rectangular plates and circular plates subjected to white random excitation are simulated numerically by two different methods. The first method is that the governing equations are reduced to a signal-degree-of-freedom dynamical system and the reduced equation is then integrated numerically by the Runge-Kutta method employing the simulated approximate white noise as an input. The second method consists in integrating the equation of motion and the compatibility equation numerically by a finite-difference method employing the simulated approximate white noise as an input. (Modified author abstract) GRA

N74-20576# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF THE STRESSED-STRAINED STATE OF AN ORTHOTROPIC CYLINDRICAL SHELL UNDER LOCALIZED LOADS
I. G. Teregulov and L. I. Mogilevkin 7 Jul. 1973 18 p refs Transl. into ENGLISH from Issled. Teor. Plastin Obolochek (Kazan), no. 6, 1970 p 775-784
(AD-773135; FTD-HT-23-453-73) Avail: NTIS CSCL 20/11

The report discusses the use of a computer in calculating the stressed state of a cylindrical shell. GRA

N74-20577# Army Coating and Chemical Lab., Aberdeen Proving Ground, Md.
INVESTIGATING HEAT TRANSFER CHARACTERISTICS OF LUBRICANTS FOR INTERNAL-COMBUSTION ENGINES Final Report
Maurice E. LePera and George E. Oswald Jan. 1974 22 p refs
(Contract DA Proj. 1T6-62611-A-107)
(AD-772917; CCL-3009) Avail: NTIS CSCL 11/8

The heat transfer properties of automotive engine lubricants and basestocks were defined in terms of a calculated Figure of Merit values, determined by utilization of measured Thermal Conductivity, Specific Heat, Density, and Viscosity, revealed that lubricant basestock and the additive constituents have a significant effect on the resultant heat transfer characteristics of the lubricant. Formulated engine lubricants meeting MIL-L-2104C and MIL-L-46152 as well as two ASTM Reference Oils were evaluated. A multiviscosity product, Grade 10W-40, was found to exhibit the lowest heat transfer characteristics of all products examined indicating a need for additional work. Author (GRA)

N74-20578# Naval Ship Research and Development Center, Bethesda, Md.
A GENERAL PURPOSE DATA GENERATOR FOR FINITE ELEMENT ANALYSIS Final Report
James M. McKee and Evan Marcus Apr. 1973 191 p refs (SR53532106)
(AD-772518; NSRDC-4066) Avail: NTIS CSCL 09/2

A computer program system has been developed to automate the preparation of a finite element model to be analyzed using the NASTRAN general purpose structural analysis program. Using engineering conventions and modular building block specifications, the program minimizes both the manual effort and the probability of an undetected error in the preparation of NASTRAN data. The document is intended to be both a guide for the user of the program and a programmer's reference for the modification and further development of the program. Author (GRA)

N74-20579# Pisa Univ. (Italy). Inst. of Aeronautics.
FATIGUE BEHAVIOUR OF HAT SECTION STRINGER STIFFENED PANELS COMPRESSED IN THE POST-BUCKLING RANGE Final Technical Report
A. Salvetti and C. Casarosa Jul. 1973 89 p refs
(Contract DAJA37-72-C-1280)
(AD-773672) Avail: NTIS CSCL 11/6

The report presents results of research on the fatigue behaviour of riveted hat section stringer stiffened panels which buckle under constant amplitude fatigue loading. Panels made with 2024-T3 as well as 7075-T6 Aluminum alloys were tested, and cracks were found to develop systematically in the stringer top plate along the rivet lines. It was demonstrated that the tensile bending stresses which take place in the stringer when the sheet cover buckles are responsible for crack initiation. The fatigue cracked panels were statically tested. Results are discussed. GRA

N74-20580# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DEFORMATION OF A FIBERGLASS REINFORCED PLASTIC CYLINDRICAL SHELL ENCLOSED IN A THICK-WALLED ELASTIC CYLINDER
A. D. Gruskov and V. D. Protasov 17 Jan. 1974 13 p refs Transl. into ENGLISH from Mekh. Polim. (Riga), no. 1, 1973 p 164-168
(AD-773878; FTD-HT-23-795-74) Avail: NTIS CSCL 11/4

A solution is presented for the problem of axisymmetrical deformation of an orthotropic fiberglass reinforced plastic cylindrical shell of finite length enclosed in a soft transversally isotropic elastic cylinder. A radial load locally distributed along the inner surface to the shell is arbitrarily axisymmetrical, permitting expansion into Fourier series. It is assumed that on the ends the shell and the elastic cylinder are connected by a diaphram, rigid in and flexible outside its plane. Author

N74-20581# Army Foreign Science and Technology Center, Charlottesville, Va.
MECHANICS OF DEFORMABLE SOLIDS - EURASIAN COMMUNIST COUNTRIES Biennial Study
Roy H. Geiss and Philip W. Johnson 15 Sep. 1973 75 p

refs
(AD-773334; FSTC-CS-01-100-74) Avail: NTIS CSCL 20/12

The study reports on ECC research and development in the mechanics of deformable solids. Topics covered include fracture and fracture mechanics, fatigue, wear, strengthening mechanisms and finite element methods. It summarizes the most important and recent theories, presents experimental approaches where appropriate, and gives examples applied to materials of known or expected military significance. The impact of the improvement of existing and development of new materials as a consequence of advanced technology is discussed with respect to developments of ECC military technology. Author (GRA)

N74-20582# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STABILITY OF SHELLS OF REVOLUTION UNDER AXIAL COMPRESSION AND EXTERNAL PRESSURE
N. Kh. Sagimova and K. Z. Galimov 17 Jan. 1974 40 p refs Transl. into ENGLISH from Issled. Teor. Plastin Obolochek (Kazan), no. 8, 1972 p 178-199
(AD-773494; FTD-HT-23-358-74) Avail: NTIS CSCL 20/11

The stability of shells under axial compressions and external pressure is studied in a linear formulation. GRA

N74-20583# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ANTI-RESONANT FREQUENCY AND THE MEASUREMENT OF MECHANICAL ADMITTANCE DATA
Ronald L. Bagley 10 Dec. 1973 44 p refs
(Contract F19628-73-C-0002; AF Proj. 649L)
(AD-773307; TN-1973-53; ESD-TR-73-339) Avail: NTIS CSCL 20/11

The undamped and damped anti-resonant frequencies of mutual mechanical admittances are defined. Their relationship to the magnitude of error introduced into measured mechanical admittances by the shaker is determined. The shaker error is minimized at anti-resonant frequencies of the mutual admittance of the degree of freedom where the shaker is attached. Experimental verification is given. Author (GRA)

N74-20584# Ballistic Research Labs., Aberdeen Proving Ground, Md.
PARAMETRIC INFLUENCES ON THE RESPONSE OF STRUCTURAL SHELLS
Norris J. Huffington, Jr. and John D. Wortman Dec. 1973 37 p refs
(DA Proj. 1W0-62117-AD-51)
(AD-773666; BRL-1689) Avail: NTIS CSCL 20/11

The effects on structural response produced by variation of geometric, loading, and material property parameters have been investigated for the specific case of a fixed-ended cylinder subjected to a frontal cosine distribution of impulsive loading (although many qualitative results can be expected to apply to other cases). Responses were determined using the REPSIL code, which employs a finite difference method to solve the partial differential equations for large deflection, anelastic shell motions. Graphical representations of results in terms of six nondimensional quantities make it possible to obtain an overview of the influence of various system parameters on structural response and to draw certain conclusions regarding their relative importance. An empirical model based on REPSIL code data has been developed which permits rapid estimation of cylinder responses over a useful range of system parameters.
Author (GRA)

N74-20585# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STABILITY OF A THREE-LAYER CONICAL SHELL UNDER THE ACTION OF HEATING, AXIAL COMPRESSIVE FORCES, AND INTERNAL PRESSURE
N. K. Galimov and Kh. M. Mushtari 9 Jan. 1974 43 p refs Transl. into ENGLISH from Issled. po Teorii Plastin i Obolochek (USSR), no. 8, 1972 p 109-143
(AD-773270; FTD-HT-23-357-74) Avail: NTIS CSCL 20/11

A coordinate system and loading diagrams are used to determine the stability of a three layer conical shell. Axial forces and moments are designated by linear equations of equilibrium. Formulas are given for determining loss of stability through axial compressive forces and external pressure. It is concluded that a three layer shell loses stability with the formation of a half wave in the direction of the generatrix. S.K.W.

N74-20586# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
PLASTIC ANALYSIS OF MIXED MODE PLANE STRESS CRACK PROBLEMS
John W. Hutchinson and C. -F. Shih Sep. 1973 14 p refs
(Grant AF-AFOSR-2476-73; AF Proj. 9782)
(AD-773773; DEAP-S-4; AFOSR-74-0101TR) Avail: NTIS CSCL 20/12

Two parameters are identified for characterizing the deformation in the plastic zone near the tip of a crack when mixed mode conditions prevail. Details of the near-tip stress and strain distributions are presented for hardening materials in which a diffuse plastic zone occurs under plane stress conditions. For small scale yielding the two near-tip parameters are related to the two elastic stress intensity factors for combined Mode 1 and Mode 2. Author (GRA)

N74-20587# Transport and Road Research Lab., Crowthorne (England).
LARGE-DEFLECTION ELASTO-PLASTIC BUCKLING ANALYSIS OF PLATES USING FINITE ELEMENTS
M. A. Crisfield 1973 54 p refs
(PB-226198/OGA; TRRL-LR-593) Avail: NTIS HC $3.50 CSCL 13B

The formulation of the large deflection behavior of elastic-plastic plates is given and numerical solutions obtained using the finite element method. Illustrative examples include the collapse analysis of plate panels subject to compression and shear respectively. Author (GRA)

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N74-20588 Princeton Univ., N.J.
THE STARTING TRANSIENT OF SOLID-PROPELLANT ROCKET MOTORS WITH HIGH INTERNAL GAS VELOCITIES
Ph.D. Thesis
Arie Peretz 1973 258 p
Avail: Univ. Microfilms Order No. 74-2351

The starting transients of high-performance solid-propellant rocket motors having small port-to-throat area ratios are inaccurately predicted and unsatisfactorily analyzed by either the widely used lumped chamber-parameter models, or the quasi-steady one-dimensional flow models. In this study, a comprehensive analytical model has been developed to describe the transfer of mass, momentum and heat, and the fast ignition propagation along the port of monolithic rocket motors with high internal gas velocities during the three major phases of the starting transient, (1) induction, (2) flame spreading, and (3) chamber filling. Both time and space development of the flow field in the motor are considered. Dissert. Abstr.

N74-20589*# Florida Univ., Gainesville. Engineering and Industrial Experiment Station.
PREDICTION OF EXPLOSIVE YIELD AND OTHER CHARACTERISTICS OF LIQUID ROCKET PROPELLANT EXPLOSIONS
Final Report
E. A. Farber, J. H. Smith, and E. H. Watts 30 Jun. 1973 424 p refs
(Contract NAS10-1255)
(NASA-CR-137372) Avail: NTIS HC $24.25 CSCL 21I

Work which has been done at the University of Florida in arriving at credible explosive yield values for liquid rocket propellants is presented. The results are based upon logical methods which have been well worked out theoretically and verified through experimental procedures. Three independent methods to predict explosive yield values for liquid rocket

propellants are described. All three give the same end result even though they utilize different parameters and procedures. They are: (1) mathematical model; (2) seven chart approach; and (3) critical mass method. A brief description of the methods, how they were derived, how they were applied, and the results which they produced are given. The experimental work used to support and verify the above methods both in the laboratory and in the field with actually explosive mixtures are presented. The methods developed are used and their value demonstrated in analyzing real problems, among them the destruct system of the Saturn 5, and the early configurations of the space shuttle. Author

N74-20590*# Scientific Translation Service, Santa Barbara, Calif.
RELIABILITY OF EXISTING METHODS FOR CALCULATING THE HEAT TRANSFER BETWEEN THE GAS AND A COOLED TURBINE BLADE
Ye. P. Dyban and V. G. Glushchenko Washington NASA Mar. 1974 15 p refs Transl. into ENGLISH from Teplofiz. Teplotekh. (Kiev), no. 23, 1973 p 29-34
(Contract NASw-2483)
(NASA-TT-F-15425) Avail: NTIS HC $4.00 CSCL 20M

Local and mean gas/blade heat transfer coefficients calculated by several available methods are compared with experimental data obtained in the solution of inverse steady state heat conduction problems for two rings of cooled stator blades. It is shown that the observed discrepancy between the calculated and experimental coefficients at the leading edges and at blade sections with laminar, transition and turbulent boundary layers can be greatly reduced by allowing for the degree of external flow turbulence. Two empirical relations, one for convex and one for concave surfaces are proposed for calculating heat transfer at blade trailing edges. Author

N74-20591*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
JET ENGINE EXHAUST EMISSIONS OF HIGH ALTITUDE COMMERCIAL AIRCRAFT PROJECTED TO 1990
Jack Grobman and Robert D. Ingebo Washington Mar. 1974 86 p refs
(NASA-TM-X-3007; E-7822) Avail: NTIS HC $4.00 CSCL 21B

Projected minimum levels of engine exhaust emissions that may be practicably achievable for future commercial aircraft operating at high-altitude cruise conditions are presented. The forecasts are based on:(1) current knowledge of emission characteristics of combustors and augmentors; (2) the status of combustion research in emission reduction technology; and (3) predictable trends in combustion systems and operating conditions as required for projected engine designs that are candidates for advanced subsonic or supersonic commercial aircraft fueled by either JP fuel, liquefied natural gas, or hydrogen. Results are presented for cruise conditions in terms of both an emission index (g constituent/kg fuel) and an emission rate (g constituent/hr). Author

N74-20592*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL TRANSIENT VANE TEMPERATURES IN A CASCADE FOR GAS STREAM TEMPERATURE CYCLING BETWEEN 922 AND 1644 K (1200 AND 2500 F)
Daniel J. Gauntner and Albert Kaufman Washington Apr. 1974 19 p refs
(NASA-TM-X-3005; E-7755) Avail: NTIS HC $3.00 CSCL 20M

Experimental transient turbine vane metal temperatures were obtained from tests conducted on air-cooled vanes installed in a four-vane cascade for a gas temperature cycled between 922 and 1644 K (1200 and 2500 F). Transient data were recorded by a high-speed data acquisition system. Temperatures at the same phase of each transient cycle were repeatable between cycles to within 11 kelvins (20 F), simulated cruise and idle steady-state readings were repeated by the cruise and idle readings taken from the ends of a transient half-cycle at low pressure to within 17 kelvins (30 F). The tests were conducted at perssure levels of 31 and 83 N-sq cm (45 and 120 psia) with coolant temperatures of 811 and 589 K (1000 and 600 F), respectively. Author

N74-20593*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN ADVERSE EFFECT OF FILM COOLING ON THE SUCTION SURFACE OF A TURBINE VANE
Herbert J. Gladden and James W. Gauntner Washington Apr. 1974 27 p refs
(NASA-TN-D-7618; E-7744) Avail: NTIS HC $3.00 CSCL 20M

Film-cooling-air ejection from the suction surface of a turbine vane was investigated. This investigation was conducted in a four-vane cascade on a J75 size turbine vane which had a row of holes near the leading edge. The experimental data are presented. It was found that a small amount of film-cooling air has a detrimental effect on the downstream vane wall cooling effectiveness. It was also shown that the presence of the film-cooling holes, without blowing, also cause an increase in vane wall temperatures. These results came from an increase in the gas-side heat transfer coefficient that was apparently caused by a laminar or transitional boundary layer becoming transitional or turbulent. Author

N74-20594*# Techtran Corp., Glen Burnie, Md.
HEAT TRANSFER INTENSITY IN THE CONDENSATION SECTION OF A HEAT PIPE
V. I. Sasin and A. I. Shelginsky Washington NASA Apr. 1974 7 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (Moscow), v. 25, no. 3, Sep. 1973 p 436-439
(Contract NASw-2485)
(NASA-TT-F-15449) Avail: NTIS HC $4.00 CSCL 20M

A dimensionless equation for calculating the heat transfer intensity in the condenser of a heat pipe is derived from dimensionless analysis of the fundamental convective heat transfer equations. The influence of vapor pressure on the heat transfer intensity in a heat pipe condenser is determined and experimental condenser heat transfer data are generalized. Author

N74-20595*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
SPACE SHUTTLE VEHICLE ROCKET PLUME IMPINGEMENT STUDY FOR SEPARATION ANALYSIS. TASKS 2 AND 3: DEFINITION AND PRELIMINARY PLUME IMPINGEMENT ANALYSIS FOR THE MSC BOOSTER
Carl J. Wojciechowski, Morris M. Penny, and Robert J. Prozan Nov. 1970 136 p
(Contract NAS9-11156)
(NASA-CR-134214; LMSC/HREC-D162657) Avail: NTIS HC $10.00 CSCL 21H

The results are presented of a space shuttle plume impingement study for the Manned Spacecraft Center configuration. This study was conducted as two tasks which were to (1) define the orbiter main stage engine exhaust plume flow field, and (2) define the plume impingement heating, force and resulting moment environments on the booster during the staging maneuver. To adequately define these environments during the staging maneuver and allow for deviation from the nominal separation trajectory, a multitude of relative orbiter/booster positions are analyzed which map the region that contains the separation trajectories. The data presented can be used to determine a separation trajectory which will result in acceptable impingement heating rates, forces, and the resulting moments. The data, presented in graphical form, include the effect of roll, pitch and yaw maneuvers for the booster. Quasi-steady state analysis methods were used with the orbiter engine operating at full thrust. To obtain partial thrust results, simple ratio equations are presented. Author

N74-20596*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF GEOMETRICAL AND FLOW PARAMETERS ON HIGH-EFFECTIVENESS REGION OF FILM COOLING
Willis H. Braum Washington Apr. 1974 32 p refs
(NASA-TN-D-7636; E-7538) Avail: NTIS HC $3.25 CSCL 20M

Previous analyses for an inviscid jet injected into a stream and the turbulent mixing region which forms between jet and stream are used to find the extent of the core region in a cooling film by calculating the growth of the turbulent boundary layer on the downstream wall. The core is a region of nearly

perfect effectiveness which ends at the intersection of the boundary layer and the mixing region. The calculations show that the most important geometrical factor bearing on the length of the core is the curvature of the wall. When the radius of curvature is large, the boundary layer remains thin and the core is long. The effects of Reynolds number, total-pressure difference between film and stream, and lateral position of the downstream wall are also investigated. The step configuration is shown to have a longer core than the slot for the same flow conditions. Author

N74-20597# Brookhaven National Lab., Upton, N.Y.
THERMODYNAMIC PROPERTIES OF LIQUID K-Na ALLOYS
M. I. Kalinin [1973] 9 p refs Transl. into ENGLISH from Zh. Prikl. Khim. (Moscow), v. 46, no. 7, 1973 p 1485-1488 Sponsored by AEC
(BNWL-TR-98) Avail: NTIS HC $3.00 CSCL 20M

Results show that in K-Na solutions, a relatively small positive-negative departure from Raoult's law in potassium activity and only negative departures in sodium activity are detected. This alloy reaction is explained by the presence of structural groups of metallic composition Na2K in the liquid alloy. The formation of alloys is accompained by an exothermal heat effect. The molar entropy of the mixture attests to the ordering in K-Na alloys. Liquid potassium and sodium alloys are formed with volume decrease. Author (NSA)

N74-20598# United Kingdom Atomic Energy Authority, Harwell (England). Chemical Engineering Div.
POST DRYOUT HEAT TRANSFER IN NUCLEAR AND CRYOGENIC EQUIPMENT
N. A. Bailey, J. G. Collier, and J. C. Ralph Aug. 1973 36 p refs
(AERE-R-7519) Avail: AEC Depository Libraries HC $4.00 CSCL 20M

Heat transfer in the liquid deficient region downstream of the dryout location is considered in relation to the performance of stream generating reactors, once-through steam generators, and cryogenic vaporizers. This model divides the heat transfer mechanism into two processes; heat transfer from the wall to a superheated boundary layer and evaporation of entrained droplets in the superheated vapour core assuming no droplet/wall interaction. Measurements were made of wall temperatures downstream of dryout. The data are compared with existing correlations and analyzed in an attempt to separate the components of droplet deposition and forced convection in the liquid deficient region as droplet/wall interaction was then significant. A method is proposed whereby the water-side heat transfer characteristics determined using electrically heated tubes may be used to estimate the variation in tube wall temperatures in a sodium-heated steam generator. Author (NSA)

N74-20599# Naval Ordnance Lab., White Oak, Md.
INDUCTION FIRING SYSTEM FOR HERO-PROOF LAUNCH INITIATION OF ORDNANCE FROM MORTARS, GUNS, ROCKET LAUNCHERS
Frederick E. Warnock 20 Jun. 1973 53 p refs
(AD-772482; NOLTR-73-129) Avail: NTIS CSCL 19/1

A RADHAZ- and HERO-proof induction firing system for initiating launch of ordnance from mortars, guns, rocket launchers, etc., is designed and analyzed. The system is being used in the Rapid Bloom Off-board Chaff (RBOC) mortar development, and is to be used in the production system. Inductive coupling of the ordnance round to the launcher allows the round to contain an electrically initiated detonator which fires or launches the ordnance, but the round is never directly electrically connected to the launcher. An analytical model is developed as an analysis and design tool, and is applied (with the help of a computer program) to the development of experimental models. (Modified author abstract) GRA

N74-20600# New York Univ., N.Y. School of Engineering and Science.
APPLICATIONS OF ACTIVE COOLING TO NOSE CONES Final Report
Victor Zakkay and Chi Rong Wang Nov. 1973 124 p refs
(Contract F33615-72-C-1370; AF Proj. 7065)
(AD 773178; ARL-73-0143) Avail: NTIS CSCL 16/3

The use of film cooling for protecting a nose cone in a hypersonic Mach 6 freestream was investigated experimentally. Tests were performed in a Mach 6 wind tunnel with a contoured axisymmetric nozzle. Downstream and upstream tangential slot injections were applied to investigate the film cooling effectiveness on the surface of a nose cone. Multiple tangential downstream slot injections were used to cool the surface of the blunt nose cone while tangential upstream slot injections were used for the surface cooling of a sharp nose cone. Air at a stagnation temperature of 530 degrees R was used as an injectant. Surface distributions of the heat transfer rates and static pressures were measured for different injection mass flow rates. (Modified author abstract) GRA

N74-20601# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
FLUCTUATIONS IN HEAT FLUX AS OBSERVED IN THE EXPANDED FLOW FROM THE RENT (REENTRY NOSE TIP) FACILITY ARC HEATER Technical Report, Oct. 1969 - Oct. 1972
Edmund G. Brown-Edwards Nov. 1973 78 p refs
(AD-772671; AFFDL-TR-73-102) Avail: NTIS CSCL 16/3

A large number of heat flux profiles from the test jet of the Re-Entry Nose Tip (RENT) Test Leg of the 50 MW Facility have been evaluated. These were obtained using null-point calorimeters. Only those profiles taken at fixed arc heater conditions of 1500 psig arc heater air pressure and 2600 amps arc current were used. The heat flux profiles showed that large fluctuations in heat flux were present in the test stream for all nozzles used. The main frequency of the fluctuations was found to be in the 100 Hz range. The fluctuations were approximately plus or minus 20% about the mean level. It is concluded that the average heat flux level determined from a minimum of ten profiles should be established for each arc heater operating condition. This value should then be used as input information for analysis of ablation behavior. Author (GRA)

N74-20602# Naval Ordnance Lab., White Oak, Md.
A MOBILE FIELD LABORATORY FOR FIRES OF OPPORTUNITY Final Technical Report
Raymond S. Alger and John R. Nichols 3 Oct. 1973 114 p refs
(AD-772481; NOLTR-73-87) Avail: NTIS CSCL 13/12

Techniques for preventing and suppressing large fires can be improved with a better understanding of fire characteristics and their relationship to the fuel and environment. The Fires of Opportunities program was designed to provide some of this information by generating portraits of large fires in both planned and unplanned circumstances. Part of the program involved the procurement or development of sensors to measure the appropriate fire parameters and the assembly of an instrument trailer to serve as a mobile field laboratory. The report describes the present field facilities and some of the techniques developed while acquiring portraits of large Class A and B fires. Author (GRA)

N74-20603# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
DEVELOPMENT OF IMPROVED INCENDIARY IGNITION SYSTEMS Final Report, 10 Feb. 1972 - 10 Feb. 1973
Alexander P. Hardt Apr. 1973 119 p refs
(Contract F08635-72-C-0123; AF Proj. 1082)
(AD-773847; LMSC-D313642; AFATL-TR-73-99) Avail: NTIS CSCL 21/2

The object of this research program was to study factors leading to the improved initiation of incendiary devices. The study concentrated on gasless reactions of which intermetallic and thermite reactions were chosen for special emphasis. This research was a continuation of another study which theoretically and experimentally established a reaction model for the initiation and propagation of pyrotechnic gasless reactions. It was shown that all such reactions are thermally initiated; that such initiation could be effected by heat, spark, shock, and laser energies; and that the initiation energies can be predicted by thermodynamics. (Modified author abstract) GRA

N74-20604*# Naval Ordnance Lab., White Oak, Md.
SMALL SCALE GAP TEST (SSGT) DATA COMPILATION;

1959-1972. VOLUME 1: UNCLASSIFIED EXPLOSIVES Final Report
James N. Ayres, Louis J. Montesi, and Ronal J. Bauer 26 Oct. 1973 388 p refs
(NASA Order T-32602-G)
(NASA-CR-138034; AD-773743; NOLTR-73-132) Avail: NTIS CSCL 19/4

Over forty different explosives and types of explosives compositions have been fired in the Small Scale Gap Test (SSGT) by the Initiation Research Group at the Naval Ordnance Laboratory (NOL) during the period 1959 to 1972. Many times there have been replicate firing, firing at high and low temperatures, batch-to-batch variational studies, tests of influence of composition on sensitivity, etc. These data -- over 500 data points derived from over 12,000 shots make the data readily available to the reader. Test methods have been described. A minimal amount of discussion of the data has been included to demonstrate some of the ways the data can be used. This report is in two volumes of which this is Volume 1. Author (GRA)

N74-20605# Purdue Univ., Lafayette, Ind. Project Squid Headquarters.
THE EFFECT OF STRAIN ON DIFFUSION FLAMES
George F. Carrier (Calif. Inst. of Tech., Pasadena), Francis E. Fendell (NTRW Systems Group, Redondo Beach), and Frank E. Marble (Calif. Inst. of Tech., Pasadena) Oct. 1973 71 p refs (Contract N00014-67-A-0226-0005; N00014-67-A-0298-0033; Grant NSF GP-34723; NR Proj. 098-038; Proj. Squid)
(AD-773480; SQUID-TR-TRW-5-PU) Avail: NTIS CSCL 21/2

Several steady-state and time-dependent solutions to the compressible conservation laws describing direct one-step near-equilibrium irreversible exothermic burning of initially unmixed gaseous reactants, with Lewis-Semonov number unity, are presented. The quantitative investigation first establishes the Burke-Schumann thin-flame solution using the Shvab-Zeldovich formulation. Real flames do not have the indefinitely thin reaction zone associated with the Burke-Schumann solution. Singular perturbation analysis is used to provide a modification of the thin-flame solution which includes a more realistic reaction zone of small but finite thickness. The particular geometry emphasized is the unbounded counterflow such that there exists a spatial constant rate of strain along the flame. (Modified author abstract) GRA

34 GENERAL

Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N74-20606+ Science Research Council, London (England).
SEVENTH TWO-YEARLY CATALOGUE OF REPORTS AND REPRINTS BETWEEN JANUARY 1972 AND DECEMBER 1973
Dec. 1973 24 p refs
Avail: NTIS HC $4.25

A subject index of bibliographies of scientific literature of several countries is presented. Subject areas included are: astronomy, atmospheric physics, geodesy, magnetic fields, meteorology, radiation, and tracking. Author

N74-20607+ National Aeronautical Establishment, Ottawa (Ontario).
PUBLICATIONS OF THE DIVISION OF MECHANICAL ENGINEERING AND THE NATIONAL AERONAUTICAL ESTABLISHMENT, SERIES NO. 2, SUPPLEMENT NO. 5
Jan. 1974 27 p refs
Avail: NTIS HC$4.50; Natl. Aeron. Estab., Reports Sect., Montreal Road, Ottawa, Ontario, K1A 0R6

A bibliography is presented of 368 articles. Aeronautical, mechanical engineering, and test reports are included along with feature articles from Quarterly Bulletins. K.M.M.

N74-20608+ Science Research Council, London (England).
LIST OF REPORTS AND REPRINTS. INCORPORATING ISSUE 2 1972 AND ISSUES 1 AND 2 1973
1973 19 p refs
Avail: NTIS HC $4.00

A subject index of bibliographies of scientific literature of several countries is presented. Subject areas included are: astronomy, atmospheric physics, geodesy, magnetic fields, meteorology, radiation and tracking. Author

N74-20609*+ National Aeronautics and Space Administration, Washington, D.C.
NASA-PATENT ABSTRACTS BIBLIOGRAPHY: A CONTINUING BIBLIOGRAPHY (CUMULATIVE ISSUE). SECTION 1: ABSTRACTS
Jan. 1974 756 p refs
(NASA-SP-7039(04)-Sect-1) Avail: NTIS HC $9.00 CSCL 05B

This bibliography lists 2594 NASA patents and applications for patents introduced into the NASA scientific and technical information system between May 1969 and December 1973. The publication is issued in two sections: (1) abstracts and (2) Indexes. Each entry in the Abstract section consists of a citation, an abstract, and in most cases, a key illustration selected from the patent or application for patent. The index section contains five indexes -- subject, inventor, source, number, and accession number. Author

N74-20610*+ National Aeronautics and Space Administration, Washington, D.C.
NASA PATENT ABSTRACTS BIBLIOGRAPHY: A CONTINUING BIBLIOGRAPHY (CUMULATIVE ISSUE). SECTION 2: INDEXES
Jan. 1974 446 p refs
(NASA-SP-7039(04)-Sect-2) Avail: NTIS HC $4.50 CSCL 05B

For abstract, see N74-20609.

N74-20611 Southern Methodist Univ., Dallas, Tex.
MULTILEVEL HIERARCHICAL SYSTEM IDENTIFICATION IN LARGE-SCALE DISCRETE-TIME SYSTEMS WITH APPLICATION TO POWER SYSTEMS Ph. D. Thesis
Samir Adib Arafeh 1973 193 p
Avail: Univ. Microfilms Order No. 74-5165

Discrete-time system identification in stochastic large-scale systems is considered. Discrete-time sequential hierarchical identification algorithms, suitable for known and unknown system noise moments, are obtained. Multilevel and composite multilevel coordinated system identification procedures are obtained, where each subsystem unit can be treated independently in seeking the overall system optimality. The application of hierarchical identification techniques to power systems are considered. A three-area power system model is used to demonstrate the hierarchical decomposition of the original system. A digital simulation is also conducted to identify four unknown parameters of the three-area system and to show the advantages of the hierachical solution in dealing with system complexity and computational requirements. Dissert. Abstr.

N74-20612# Committee on Science and Astronautics (U. S. House).
AUTHORIZING APPROPRIATIONS TO THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Teague Washington GPO 1974 178 p Rept. to accompany H.R. 13998 presented by the Comm on Sci. and Astronaut. to the Comm. of the Whole House on the State of the Union, 93d Congr., 2d Sess., 10 Apr. 1974
Avail: US Capitol, House Document Room

The hearings on authorization of appropriations to NASA are presented. Cost analyses for fiscal year 1975 are presented for research and development programs, construction of facilities, and program management. S.K.W.

N74-20613# Office of the White House Press Secretary, Washington, D.C.
[NATIONAL ENERGY POLICY FOR MEETING US ENERGY REQUIREMENTS]
Richard Nixon 18 Apr. 1973 19 p

Avail: NTIS HC $4.00

The President's energy policy proposals to Congress on April 18, 1973 are presented. Recommendations were made for the increased production of energy as well as more judicious use of energy resources. The following specific actions were proposed: (1) increased production and use of natural gas; (2) utilization of the oil and gas resources of the Outer Continental Shelf; (3) construction of the Alaska pipeline; (4) development of shale oil; (5) increased utilization of geothermal resources; (6) expanded development and utilization of coal resources; (7) rapid development of nuclear power plants; and (8) exploration of domestic mineral resources. The development of deepwater ports for facilitating imports was also recommended. The establishment of the Federal Energy Organization was outlined. S.K.W.

N74-20614# New York State Office of Economic Research, Albany.

CONSUMPTION OF ENERGY IN NEW YORK STATE: 1972 (WITH ESTIMATES FOR 1973)

Olaf Hausgaard Jan. 1974 32 p refs Supplement to OER-10 Supersedes OER-15

(OER-19; OER-10-Suppl; AER-15) Avail: NTIS HC $4.75

Revisions in the 1971 consumption data for fossil fuels reveal that energy consumption in New York State in 1971 was 4,239.3 T-BTU, a drop of 53.6 T-BTU from 1970 (-1.2%). The decline was a result of an unprecedented drop in fossil fuel demand by the industrial section from 577.6 T-BTU in 1970 to 455.4 T-BTU in 1971. In 1972 the industrial sector consumed 414.8 T-BTU from fossil fuels, a decline of 8.9% from the 1971 level. During both 1971 and 1972 the other three major energy consuming sectors continued their upward trend in energy consumption.

Author

N74-20615*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

DATA CATALOG OF SATELLITE EXPERIMENTS

Oct. 1973 616 p refs Supplement to NSSDC-71-20

(NASA-TM-X-69990; NSSDC-73-11; NSSDC-71-20-Suppl-1) Avail: NTIS HC $34.00 CSCL 05B

The availability of space science data, a description of the data, and a description of the services supplied by the National Space Science Data Center (NSSDC) is presented. A series of cumulative indexes that reference the data descriptions contain: (1) a chronological listing of all spacecraft, experiments, and data descriptions; (2) an index of all spacecraft described, identified by common names and alternate names; (3) a listing of the original experiment institutions for experiments described; (4) a listing of the investigators associated with the experiments and their current affiliations; and (5) two displays of information about experiment data coverage for fields and particle data and a listing of all experiments sorted by phenomenon measured.

Author

N74-20616# Interior Dept., Washington, D.C.

FINAL ENVIRONMENTAL STATEMENT FOR THE GEOTHERMAL LEASING PROGRAM. VOLUME 1: PROMULGATION OF LEASING AND OPERATING REGULATIONS

1973 485 p refs 4 Vol.

Avail: SOD HC $4.20

Public lands potentailly available for geothermal leasing are described. These include principally: (1) public, withdrawn, and acquired lands administered by the Secretary of the Interior; (2) national forests and other lands administered by the Forest Service, Department of Agriculture; and (3) lands containing a reservation to the United States of the geothermal resources. These lands total 638 million acres. The most promising geothermal resource areas are located predominantly in the 11 western States and Alaska. Included in this proposed action are: (1) the promulgation of leasing and operating regulations pursuant to which the program would be administered; and (2) the leasing of federally owned geothermal resources for development in three specific areas: (a) Clear Lake-Geysers; (b) Mono Lake-Long Valley; and (c) Imperial Valley, all in California.

Author

N74-20617# Arkansas Univ., Fayetteville. Dept. of Physics.

ENERGY IN THE NEAR TERM

Otto Henry Zinke 21 Jun. 1973 57 p refs Sponsored by Dept. of Commerce and Ford Found.

Avail: NTIS HC $6.00

The dependence of the United States on petroleum as a primary energy source is discussed. Data are presented which outline energy consumption and production estimates. Techniques which would reduce energy consumption are outlined. Correlations are made between energy consumption and employment.

S.K.W.

N74-20618# Scientific Translation Service, Santa Barbara, Calif.

BRIEF INFORMATION FROM THE STUDY GROUP OF THE MAJOR RESEARCH INSTITUTIONS ON WORK IN THE AREA OF ENVIRONMENTAL RESEARCH AND ENVIRONMENTAL PROTECTION

[1973] 58 p Transl. into ENGLISH from Kurzinformation der AGF ueber Arbeiten auf dem Gebiet der Umweltforschung und des Umweltschutzes Sponsored by EPA

(TR-640-73) Avail: NTIS HC $6.00

Environmental research and environmental protection for West Germany are outlined. Planned total expenditures in the years 1972 - 1975 are presented. Some subjects discussed are: waste disposal; environmental chemicals and biocides; water quality; and air quality. Emphasis is placed upon developments in nuclear technology such as fission product retention, environmental monitoring and radiation protection. S.K.W.

N74-20619# Bureau of Mines, Bartlesville, Okla. Enegry Research Center.

ENERGY PROGRAM, 1972

Bill Linville and John D. Spencer 1973 115 p refs

(BM-IC-8612) Avail: NTIS HC $8.75

Major areas of research by the Bureau of Mines in 1972 for the development of new and improved efficient methods of conservation and utilization for petroleum and natural gas, oil shale, and coal are described. The major objective of the energy research program was to develop the technology for the wise development and use of the nation's energy resources as clean fuels at a reasonable and competitive cost. Emphasis was placed on studies of methods of stimulating production from oil and gas reservoirs. Studies of the fracturing systems of reservoir rocks and oil recovery by water or gas flooding are included.

Author

N74-20620# National Academy of Sciences - National Research Council, Washington, D.C. Space Science Board.

UNITED STATES SPACE SCIENCE PROGRAM REPORT TO COSPAR

1974 92 p Presented at 16th COSPAR Meeting, Konstanz, West Germany, Jun. 1973

Avail: NTIS HC $7.75

This report to COSPAR on the United States space program is a compilation of contributions from organizations and individuals in the public and private sector. For the reporting year 1972, it contains brief summaries of analyses and observations, from experiments onboard spacecraft, sounding rockets, balloons, and aircraft.

Author

N74-20621# RAND Corp., Santa Monica, Calif.

ENERGY ALTERNATIVES FOR CALIFORNIA: THE CURRENT CRISIS. 1: THE IMPACT OF ARAB OIL EXPORT POLICIES ON THE CALIFORNIA ENERGY SYSTEM

William R. Ahern Dec. 1973 22 p refs

(P-5146) Avail: NTIS HC $4.25

The objectives of this presentation are: (1) to indicate the impacts of the Arab embargo of oil shipments to the United States on the California energy system; (2) to show how these impacts interrelate with the major trends in state energy supplies and uses; and (3) to identify and measure the important energy shortage allocation problems facing Federal and State officials.

Author

N74-20622# RAND Corp., Santa Monica, Calif.

COPING WITH THE FUEL SHORTAGE: A GUIDE FOR LOS ANGELES RESIDENTS

M. H. Graubard and J. J. Mutch Jan. 1974 23 p

(P-5154) Avail: NTIS HC $4.25

Energy uses and conservation measures for the Los Angeles,

California area are outlined. Charts are presented which show: the consumption rates for different household appliances; the sources of energy, and consumption of energy by automobiles. Measures for voluntary energy conservation among residents are outlined along with an emergency plan for electric utilities.
S.K.W.

N74-20623# National Bureau of Standards, Washington, D.C.
GRADUATE SCIENCE EDUCATION: STUDENT SUPPORT AND POSTDOCTORALS
Oct. 1973 193 p
(NSF-73-315) Avail: SOD HC $2.85

Detailed information on a survey of graduate education in the sciences which was conducted in the fall of 1972 is presented. Statistics on trends and patterns of enrollments of graduate science students and their support are provided. One important use of the data is to assess the impact of these future Ph.D.'s on the Nation's scientific manpower pool. The report also supplies information on the effect of the growing numbers of postdoctoral appointees assigned to graduate science departments. The survey provides the only source of data on Federal and other support of graduate education in the sciences. Author

N74-20624*# Environmental Research Inst. of Michigan, Ann Arbor.
INVESTIGATIONS IN ADAPTIVE PROCESSING OF MULTISPECTRAL DATA Technical Report, 1 Nov. 1971 - 31 Jan. 1973
F. J. Kriegler and H. M. Horwitz Aug. 1973 36 p refs
(Contract NAS9-9784)
(NASA-CR-134223; ERIM-31650-151-T) Avail: NTIS HC $5.00 CSCL 05B

Adaptive data processing procedures are applied to the problem of classifying objects in a scene scanned by multispectral sensor. These procedures show a performance improvement over standard nonadaptive techniques. Some sources of error in classification are identified and those correctable by adaptive processing are discussed. Experiments in adaptation of signature means by decision-directed methods are described. Some of these methods assume correlation between the trajectories of different signature means; for others this assumption is not made.
Author

N74-20625*# George Washington Univ., Washington, D.C.
PROGRAM OF POLICY STUDIES IN SCIENCE AND TECHNOLOGY Seven Year Review, 1966 - 1973
L. H. Mayo Apr. 1973 95 p refs
(Grant NGL-09-010-030)
(NASA-CR-137374) Avail: NTIS HC $7.75 CSCL 05A

The application of an interdisciplinary, problem-oriented capability to the performance of total social impact evaluations is discussed. The consequences of introducing new configurations, technological or otherwise into future social environments are presented. The primary characteristics of the program are summarized: (1) emphasis on interdisciplinary, problem-oriented analysis; (2) development of intra- and inter-institutional arrangements for the purpose of analyzing social problems, evaluating existing programs, and assessing the social impacts of prospective policies, programs, and other public actions; (3) focus on methodological approaches to the projection of alternative future social environments, the identification of the effects of the introduction of new policies, programs, or other actions into the social system, and the evaluation of the social impacts of such effects; (4) availability of analytical resources for advisory and research tasks, and provision for use of program facilities as a neutral forum for the discussion of public issues involving involving the impact of advancing technology on social value-institutional processes. Author

N74-20626# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Reaktorentwicklung.
APPROACH TO THE HOLISTIC ANALYSIS OF THE SYSTEM MAN-ENERGY-ENVIRONMENT
A. Voss Jul. 1973 193 p refs In GERMAN; ENGLISH summary
(JUL-982-RG) Avail: AEC Depository Libraries HC $11.75

A holistic analysis for the system man-energy-environment regarding economical, ecological, and technical aspects is presented. The aim is to comprehend all significant influence factors and interactions as well as to compare and to evaluate the positive and negative effects of an increasing energy consumption and its protection by alternative energy supply systems. For such complex systems new methods developed in the field of system engineering, especially cybernetic simulation, have to be used for the derivation of adequate aid for decision.
NSA

N74-20627# Oak Ridge National Lab., Tenn.
ENERGY RESEARCH AND DEVELOPMENT: A SELECTED READING LIST
M. P. Guthrie, ed., E. E. Huber, ed., and G. A. Norwood, ed. Nov. 1973 237 p Sponsored by NSF
(Contract W-7405-eng-26)
(ORNL-EIS-73-65) Avail: NTIS HC $14.00

A selected listing of 1,219 publications is assembled for the identification of promising areas for energy research and development. The document is designed to assist the layman. The genesis of the reading list was a need to gain a perspective on what has already been done in energy research and development. The perspective was required to support the development of a report to the President from the Chairman of the AEC on long-range energy research and development needs and policy as requested in the President's June 29, 1973 statement on Energy and National Resources. The bibliography emphasizes general publications on energy sources, electric power, generation, energy uses, and references on energy supply and demand studies. An appendix includes an author index, a simple title index, and a permuted index on titles. NSA

N74-20628# Mitre Corp., Bedford, Mass.
AIR CARGO TERMINAL SOURCE DATA ENTRY
B. A. Feldmeyer, B. L. Gerken, and J. A. Gulden Nov. 1973 68 p refs
(Contract F19628-73-C-0001; AF Proj. 572C)
(AD-772814; MTR-2632; ESD-TR-73-288) Avail: NTIS CSCL 15/5

Accurate and timely identification and descriptive data on air cargo is currently not available to managers of air cargo terminals, nor to the information and planning systems to which they supply cargo data. This report supports a Required Operational Capability (ROC) for Air Cargo Terminal Source Data Entry Devices, issued as USAF ROC 2-73. The proposed set of devices will generate machine readable data for individual pieces of cargo, read the data whenever needed, allow entry of additional data, and provide interfaces to systems requiring the data.
Author (GRA)

N74-20629# Texas Transportation Inst., College Station.
TEXAS AIRPORT SYSTEM PLAN - AIR PASSENGER DEMAND MODEL: FORECASTS AND ANALYSIS OF ALTERNATIVES
Ralph E. Foster Jan. 1973 26 p Sponsored by FAA an Office of Governor, Austin, Tex.
(AD-772470) Avail: NTIS CSCL 01/2

The forecasts of demand for air travel developed using the Air Passenger Demand Model differ from other available forecasts of commercial air travel, in that they avoid dependence on analysis or extrapolation of trends observed in air travel time series data. The computer version of the model operates as three distinct phases. Phase I develops a general travel pattern and produces a four-dimensional trip table for each demand analysis area. This trip table stipulates an area's outbound trips, by purpose and by traveler income level, to each of 324 other areas for each of three points in time. Phase II systematically checks all possible routes and travel mode combinations for each trip cell to identify the least cost trip where cost includes an imputed time value for the travel time involved and records the least cost trip. Phase III tabulates the trip records and reports air trip origins for each Texas airport having scheduled air passenger service. (Modified author abstract) GRA

N74-20630# Texas Transportation Inst., College Station.
TEXAS AIRPORT SYSTEMS PLAN - AIR PASSENGER DEMAND MODEL: MODEL TEST AND EVALUATION
Ralph E. Foster Jan. 1973 64 p refs Sponsored by FAA and Office of Governor, Austin, Tex.

(AD-772471) Avail: NTIS CSCL 01/2

The Texas Airport System Plan (TASP) is intended to identify locations where facility deficiencies are anticipated in the airport system of the State of Texas and to develop alternative courses of action designed to prevent the potential deficiencies. A deficiency is identified when, at some future time within the planning horizon, demand upon a facility exceeds its capacity. Total demand has been divided into three areas--commercial air passenger, cargo, and general aviation--which have been forecasted for planning subdivisions of the State. Forecasts of commercial air passenger demand have been prepared through the use of a complex model. The purpose of this report is to present the rationale for the selection of the methodology employed in the design and development of the Air Passenger Demand Model, to review the procedures used to test and calibrate the model, and to evaluate the model and the forecasts which it produces. GRA

N74-20631# Forecasting International Ltd., Arlington, Va.
DEVELOPMENT OF A TECHNOLOGY ASSESSMENT AND ADVANCED TECHNOLOGY TRANSFER PROGRAM FOR THE DEPARTMENT OF THE ARMY, PART 1 Final Report
Marvin J. Cetron and Lewis Roepcke 1 Jun. 1973 88 p refs
(Contract DAHC19-72-C-0031)
(AD-772087) Avail: NTIS CSCL 05/1

The study has two primary purposes: to develop a management planning tool for the Department of the Army and to evaluate specific innovations by means of it. This tool, described and demonstrated herein, can be used to make continuous assessments of the potential impacts of alternative Army research programs--including impacts both on the Army itself and on the physical and social environment with which the Army interacts. The kinds of programs which can be assessed include a wide range of possible technological, administrative, and institutional innovations. GRA

N74-20632# Defense Documentation Center, Alexandria, Va.
ENVIRONMENTAL POLLUTION: SANITARY ENGINEERING AND INDUSTRIAL WASTE Report Bibliography, Jan. 1971 - Jun. 1973
Dec. 1973 107 p refs Revised
(AD-771715; DDC-TAS-73-75) Avail: NTIS CSCL 13/2

The bibliography is comprised of 70 citations of unclassified reports dealing with sanitary and industrial wastes. Included are references to reports on pollution of oceans, rivers, and estuaries by the disposal of garbage, sewage, and wastes. In addition to aforementioned references, citations of various methods of reclamation and treatment of waste are presented from life support and closed ecological systems which may prove beneficial to ongoing research and operations for controlling environmental pollution. Corporate Author-Monitoring Agency, Subject, Title, Personal Author, Contract, and Report Number Indexes are included. Author (GRA)

N74-20633# Massachusetts Inst. of Tech., Cambridge. Center for Materials Science and Engineering.
RESEARCH IN MATERIALS SCIENCE Semiannual Technical Report, 1 Jul. - 31 Dec. 1973
D. J. Epstein, R. M. Rose, M. MacVicar, R. Lagow, R. Pelloux, and G. Benedek 31 Dec. 1973 302 p refs
(Contract DAHC15-73-C-0316; ARPA Order 2469)
(AD-773886; SATR-1) Avail: NTIS CSCL 20/6

The report presents the results and status of work after the first six month period of work on this research program which consists of five separate tasks involving research in materials science. The following topics are discussed: Optoelectronic materials and components; superconducting transition metal alloys; chemical synthesis using high temperature lithium vapor species; fatigue and fracture properties of austenitic steels; and, materials characterization using laser light scattering spectroscopy. GRA

N74-20634# Belfour Stulen, Inc., Traverse City, Mich.
THE MECHANICAL PROPERTIES DATA CENTER Annual Report, 1 Aug. 1972 - 16 Sep. 1973
Robert C. Braden Jan. 1974 34 p refs
(Contract DSA900-73-C-0758; AF Proj. 8975)
(AD-773631; AMMRC-CTR-74-3; AR-11) Avail: NTIS CSCL 11/6

The report reviews and discusses the continuing operation and development of the Mechanical Properties Data Center. The Mechanical Properties Data Center had as its objectives the acquisition, review, analysis and dissemination of available well-defined mechanical properties data on structural metals and alloys. Additionally, the Center was charged with the responsibility of establishing and maintaining a marketing-sales program for the products and services of the Center, to achieve a rate of reimbursement equal to at least 90% of the initial DOD funding. Activity and growth of the Center are discussed in terms of the six major work areas: Input, File Maintenance, Output, Systems Development, Management and Marketing-Sales. (Modified author abstract) GRA

N74-19878 Joint Publications Research Service, Arlington, Va.
POLISH EDUCATION IN THE FIELD OF AUTOMATION SCIENCE
Henryk J. Leskiewicz *In its* Transl. on Eastern Europe Sci. Affairs, No. 393 (JPRS-61413) 6 Mar. 1974 p 123-150 Transl. into ENGLISH from Arch. Automat. Telemech. (Warsaw), v. 18, no. 2, 1973 p 227-249 (For availability see N74-19871 11-10)

N74-20427 Detroit Diesel Allison, Indianapolis, Ind.
COST OF OWNERSHIP FOR PROPULSION SYSTEM OF POWERED LIFT AIRCRAFT
W. L. McIntire *In* AGARD V/STOL Propulsion Systems Jan. 1974 20 p refs (For availability see N74-20401 11-28)